INDEX TO ADVERTISERS AND CONTENTS ON PAGE 30.

THE FOUNDRY

VOL. 17. DETROIT, MICH., OCTOBER, 1900. No. 98.

PUBLISHED MONTHLY BY
THE FOUNDRY PUBLISHING CO.
DETROIT, MICH.

JOHN A. PENTON, - - - EDITOR.

SUBSCRIPTION PRICE:
$1.00 a year in advance, postage prepaid in the United States, Canada and Mexico.
$1.75 a year to other countries, postage prepaid.
Single Copies, 15 Cents.

ADVERTISING RATES ARE PRINTED IN EACH ISSUE

Space in advertising pages only is for sale.

Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.

To Foreign Subscribers we recommend the use of international postoffice money orders in sending remittances. These are both cheap and safe.

We want to obtain examples of current foundry practice. Photographs, drawings and descriptive matter, showing just what is being accomplished in the foundries of to-day, will be cheerfully paid for.

We can not furnish a continuous set of back numbers beyond June, 1900.

Entered at the Post Office at Detroit, Mich., as second-class matter.

Trade Outlook.

While the foundries are not rushed with work to the extent which prevailed several months ago, still the amount of business being done represents a fairly large volume. With temporary shut downs of mills and factories, it could not be expected that the consumption of castings should remain at the high water mark, since the conditions of foundries is but a reflection of the activity existing in other lines of industry.

As shops have become slack there has appeared more and more competition between foundries to obtain their share of work, and this has, to a certain extent, been intensified by reductions in the price of iron. The independent attitude, which proprietors of foundries could afford to assume, when nearly every order hinged more on the time of delivery, than on the question of price, has given way to the customary close figuring for contracts.

Within the past eighteen months many new foundries have been built and others have nearly doubled their capacity. As conditions return to the normal, some of these shops will naturally find it difficult to keep their shops full of work. With foundries, as with blast furnaces, it will be those best equipped and located which will set the price at which others must sell or go out of business. Of course, this law applies more to shops making a specialty of certain lines of foundry work than to jobbing shops where individual ability to turn things to one's advantage often carries the day. Yet it should not be forgotten that the foundry possessing labor-saving appliances and modern equipment throughout is the one that can produce castings at the lowest cost, other conditions being equal.

In a recent review of the market, Rogers, Brown & Co., say: "The demand continues principally for early delivery, although some contracts have been accepted for the remainder of the year and a very limited number for the first six months of next year. Standard grades of Southern iron are principally sought, and there has not been much dealing in the central territory in charcoal iron, high silicon or special brands. These will undoubtedly have their turn somewhat later. A peculiar feature of the situation is that numerous sales of certain brands have been made at very low figures, and the furnace companies most emphatically state that they have not authorized the sales and have not received the orders. One important Southern interest has practically withdrawn from the market for the remainder of the year on foundry grades because of their oversold condition. They will not accept less than $11, Birmingham, for No. 2 foundry, and other large producers claim to be holding at from $11 to $11.50. In spite of this a few companies or their agents seem to have become panic-stricken for fear there will not be enough business to go around, and, it is reliably reported, have been making sales of

No. 2 foundry at about $10, Birmingham basis. There is a decidedly more hopeful feeling among producers and consumers, and if the trade will only buy to cover legitimate wants and avoid speculation, there is every prospect for a healthy business during the remainder of the year."

Writing of market conditions, Matthew Addy & Co., say: "From the way in which orders have been placed it is evident that many consumers have reached the time when they must either replenish their stocks of iron or shut down. Or they have come to the conclusion that there is no more money to be made by waiting and they, on the other hand, may actually lose by longer postponing buying. This last idea is fast taking hold on the minds of the foundrymen. They have seen the market settle and settle over a period of many months, and at last it has halted in its downward course. The iron masters in the South state that they have reached bottom. They all had a good August, with greater sales than in any month since last October. In the Birmingham district the demand for export has been and is excellent, the largest concern there having sold last month for shipment abroad 60,000 tons. It also had fair sales for domestic use. And in Birmingham the general sentiment is that the next change will be upward. Certain it is that during the last week all of the Birmingham iron masters were offered many thousand tons of orders from 25c to $1 a ton under their schedule quotations, and all this large bulk of business was uncompromisingly refused. A few weeks ago if a man made an offer on pig iron the chances were ten to one that it would be at once accepted, and the fact today that offers are declined unless at the full market is the best witness to the change in general conditions. It speaks eloquently of the firmer tone of the market. And what is true of the Southern makers is equally true of the Northern. Orders principally are for shipment over a not longer period than through the balance of the year, though there are inquiries into next year. Of course most orders are for shipment over about sixty days. There is one thing that buyers in the North are beginning slowly to realize in regard to Southern iron, and that is that it costs a good deal more to make it than previously. For example, a buyer told us the other day that two years ago he had bought No. 2 foundry Southern at $7.50 Birmingham, and he could not understand why it could not be made as cheaply now as then. He admitted that his own costs went up in 1899. And he further admitted that he could not put them back again where they were without labor difficulties of the gravest kind. The cost of Southern iron on account of the great advance in labor has been largely increased and this increase in cost is here to stay. That is, there is no way of reducing it that is possible under present conditions."

Hot Iron.

BY EDWARD KIRK.

Many foundrymen, as well as the molders themselves, do not seem to know what hot iron really is, and call any iron that will flow from a ladle hot iron.

An iron when reduced to a molten state is, of course, a hot iron, but a molten iron may not be a hot or fluid iron in a foundry sense of the term. By this term is meant an iron that is sufficiently hot and fluid to cast the lightest or heaviest of castings, and produce a clean, sharp casting, an exact facsimile of the pattern.

To obtain such an iron it should be melted rapidly and hot, and when drawn from the cupola should be at a white heat, even if the work to be cast is heavy, and when poured into a mold should be at as near this heat as the character of the work will admit of.

This will no doubt seem a radical statement to founders and molders who have always been in the habit of melting their iron dull or chilling it down in the ladle before pouring, until it has scarcely sufficient fluidity to fill a mold properly. These men will no doubt at once say that molds will not stand such hot iron, the sand will cut, facing burn, and castings not scale, etc. To such men we would say that the output of a foundry is not molds, but castings, and molds should be made to suit castings and not castings made to suit molds.

There are sands, loams, facings, blacking, etc., that resist almost any degree of heat in molten iron; such materials may be obtained from any of our leading foundry supply houses, and it is only necessary for the founder to make known his wants to any of these concerns to obtain materials suitable for the work to be cast; and these generally cost no more than inferior articles.

In all cases material should be used that will stand hot iron, and iron should be poured hot and molds filled rapidly. This is the only way to make a sound, clean casting. Some deviation may be made from this rule when casting very heavy work that requires to be fed up, but a sufficient leeway is generally made by the iron, for when casting such work some time is required to fill a ladle, and during this time the iron is generally cooled to a sufficient extent for pouring by the time it reaches the mold.

Many founders are under the impression that iron when melted fast and very hot is burned in melting, and endeavor to not melt iron very fast or very hot. This theory is entirely wrong, and the reverse is the case. Iron melted slow and dull is burned and hardened in melting, and may be entirely ruined for the work to be cast by such melting.

This is another statement that will no doubt be criticised by many old founders, as well as younger ones, who have followed in the footsteps of the old founders, and been taught the dull iron theory of melting. But the statement is none the less correct, and founders who doubt it have only to make a little inquiry to find it to be so.

There are no founders who require a better grade of iron for their work than the stove and bench work foundries. In these shops iron must be very hot and fluid to run the castings; and when it flows from the cupola it is in many cases heated to as high a degree of heat as iron can be heated to in a cupola. If the iron was burned in melting, or presented any of the characteristics of a burned iron after casting, it could not be used for this class of work.

Cast iron is not a pure iron, but a compound of iron and various metalloids, which impart to the iron its characteristics, and give to it the various degrees of hardness, softness, etc., found in cast iron. When these metalloids are removed, or their combination with the iron changed, the characteristics of the iron are changed, and to produce an iron when cast, having the characteristics of the iron before melting, it is necessary that the iron should be properly melted, and cast in a way that will prevent the removal of metalloids or their liberation from combination with the iron; for the removal of metalloids produces a harder or softer iron than the original iron, and their liberation from combination with the iron, without removal from it, makes a dirty iron.

Some of the metalloids enter freely into combination with iron, and are removed with difficulty, while others are readily set free from their combination with iron, and it is only when the iron is in a very hot and fluid state, as a foundry iron, or in a solid state, that they are not readily set free by agitation of the iron.

When iron is melted slow and dull it is slowly heated to the melting point, and is melted from the outside, and every part exposed to the heat and action of the blast; it is not melted, but is reduced to a molten state by burning off the exposed surface.

The metalloids are exposed to the action of the heat and blast, and these, having but a limited affinity for iron, are readily removed from it in melting, and the character of an iron may be, and frequently is, entirely changed when melted in this way, which accounts for a hard iron being obtained at the spout when a soft iron has been charged.

When iron is permitted to cool in a ladle, dirt and dross will continue to rise to the surface as long as the iron remains sufficiently fluid to permit it to rise; and the more it is agitated or stirred the greater the amount of dirt that rises to the surface. This dirt is metalloids set free from combination with the iron as it changes from a molten to a solid state.

Were this not the case, and the material that rises to the surface were actually dirt in the iron, it would rise more freely from a very hot iron than from a dull iron, which is not the case, as a scum does not accumulate as rapidly on the surface of a very hot iron as on dull iron; and lumps of dirt never rise to the surface of hot iron save when set free from the lining of the ladle.

When iron is cooled in a ladle and poured dull, these metalloids are set free by flowing of the iron into the mold, but cannot escape from it as they do to the surface in a ladle, but are retained in the iron and collect in spots in a casting, making a dirty casting.

The same results are produced when a comparatively hot iron is poured through a very small gate and a mold slowly filled, and also when poured through a complicated skim-gate, which only admits of a slow filling of the mold.

When iron is properly charged in a cupola it is prepared for melting by being heated while settling to the melting zone, and when it enters this it is melted in a mass. The metalloids are not exposed to the action of the heat and blast to the same extent as when melted slowly from the outside, just above or below the zone, as is the case in slow melting.

When iron is melted in a mass in the zone, and flows from the cupola at a high heat, the iron and metalloids are in a state of chemical combination, and if changed from a molten to a solid state without being disturbed when cooling, they remain in this condition, and a clean iron is obtained.

Iron should therefore be melted hot and poured hot, that it may be placed in the mold with the metalloids in combination with the iron and permitted to cool in this condition.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

Cupola Management.

I have a letter with many questions, which I will answer without stating questions.

A cupola 60 inches diameter inside, 15 feet from charging door to tuyeres and 12 inches more to sand bottom, is large enough to melt 20 tons of iron; 1650 pounds coke would be about right for the bed. After all the wood is burned out, and when the wind is put on, the bed must reach a little above the melting point. This is not a question of weight, but of measure. If the iron is dull at start use more coke on the bed, enough to give hot iron. You should have a gauge to tell the pressure of blast. A No. 6 Roots blower is large enough to give 14 ounces of blast, but you need a wind gauge to tell what you have. The Roots people make a gauge, but for some reason divide a pound into 10 instead of 16 divisions. You can turn the scale over and change the divisions to ounces. Even if the blower is old they will give you a grease to plaster on the inside of the casing which will make the impellers work tight.

The proportions of your cupola are correct. Use as little daubing as possible, and it should be of silica sand (we call it lake sand up here), and just enough good fire clay to hold it together. If you find clay adhering to the sides do not chip it all off, but let a little accumulate each day until the shape is such that it will not burn off. You will in this way build out quite a little bosh over the tuyeres. Let the cupola shape itself. If you melt more than 12 tons you should tap off slag. For this purpose make a hole through the back of the cupola, about one inch diameter and four inches below the bottom of the tuyeres.

The slag can run down into the pit and be removed before the bottom is dropped, or you can place an iron trough lined with molding sand and a little clay wash so as to lead the stream of slag into a low place filled with water alongside the pit. To slag a cupola you must use good limestone broken the size of a chestnut or stove size coal, and use about five shovels full to the ton of iron. Scatter it over the coke. If you mill the sand off your sprues you need not use any on the first four charges. Do not tap slag until you have taken out about nine tons of iron. It is better to let the slag run all the time after that.

The bottom will drop clean if you use limestone. If you don't want to tap the slag use limestone or oyster shells on the last three charges to give you a clean drop.

After the men have all poured off, and the blast is off, pour all melted iron into the pig bed, and do not let it run over the floor in front of the cupola. When all the iron is out, with an old piece of 1½ inch shafting, let a couple of men ram in the breast and let all the slag run out on the floor. When it stops running drop the bottom. While the slag is running, with bars through the tuyeres, break down the hard slag in the cupola. The limestone will give you a clean drop. One hundred and eighty pounds of coke to a 2,000-pound charge of iron is not enough to give hot iron. If you are getting hot iron with so little coke you are doing remarkably well. A brick for the breast is better than a clay breast. The hole through the brick should be ⅝ inch and smooth. With fast melting this size will give a continuous stream.

The breast can be put in before lighting, as all the air necessary will enter through the tuyeres, but it is the general practice to get the coke well lighted up before the breast is put in.

It is better to have from 600 to 1,000

pounds of iron in the dump than to run the risk of short iron. You can put the unburned coke back in the cupola next day, so that there will not be much loss. Very often your molders will not give in the right amount of iron, and it is not safe to run too close.

If you slag a cupola you can melt any amount of iron; of course, you can only melt so much an hour.

The slag hole is only to keep the slag out of the cupola, and has nothing to do with the number and size of tuyeres. You say that you have three tuyeres on each side, about 3 inches wide by 10 inches high. If you melt fast enough, and as economically as you say, I would not change, but the tuyeres are not the shape I should use. I would use about 15 tuyeres, 6 inches wide and 4 inches high. The rule is always to leave the cupola alone if it is doing well.

Chilled Iron.

"I charged 100 pounds coal and 250 pounds coke, 1,000 pounds choice stove plate, 40 pounds of coke, 500 pounds of mixed iron, 50 pounds coke, 500 pounds iron."

"I got chilled iron all through the heat. What was the reason?"

You got out just what you put in the cupola. If you want a part chilling iron you must put in such iron. If you want iron that will not chill, do not use the same iron that you use for chilling.

There are irons that are made for chilling castings. Old car wheels are the cheapest chill scrap, and give the best satisfaction. Thin stove-plate, covered with rust, will not make very good castings unless you mix some silvery iron with it. Use silvery iron to take out chill.

A lack of silicon makes iron chill. Iron rich in silicon will seldom chill.

Krank's Korner.

It takes several years to make a good jobbing molder. He learns through a succession of failures. He always got something to learn.

After working on a few big jobs he begins to feel as gay as a frisky mule. He becomes afflicted with a case of ingrowing nerve which leads him to believe he is the whole thing. Who ever heard a machinery molder boast of the small jobs he had made?

* * * * *

The only thing that will humble one of these fifty-ton fellows is to put him on a side floor and give him some little crooked job on which he can do no patching. Nine times out of ten he will get rattled. He can't get a clean lift, his mold will tear in getting the pattern out, and usually he will pick up his coat and quit with the remark that he will be keelhauled before he will work on chicken-feed.

* * * * *

He lacks the patience necessary to make such jobs. His experience has been all the other way. Whenever he gets a casting with a light core he believes he has got the worst problem to solve in the world. He thinks that way because he does not know that there are others making more difficult castings every day without thinking it anything remarkable.

As bearing upon this subject I append an article from an unknown contributor to "Age of Steel."

Difficult Foundry Work.

One time in describing an apparatus called a "dry-press," for drying veneer, I ventured the remark that the making of the plates for one of these presses was a job that no foundryman would yearn for, except as an instance in which to show or test his skill in the art. The plates for these presses run about three inches thick, fifteen to twenty-four inches wide, and thirty to sixty inches long. They are to be hollow, and must carry live steam up to boiler pressure.

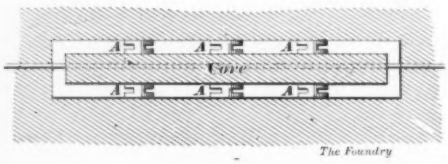
In making the plates it becomes essential, too, to bear in mind the purpose for which they are intended—drying veneer from the heat of live steam, while holding it pressed flat between the plates—because it becomes apparent that to make the hollow in the plate too small, and leave the iron body correspondingly thick, cuts off a little from the effective usefulness of the apparatus. The proportion aimed at is to get the sides about three-quarters of an inch thick—which would call for an inch and a half core in the center—and it was with this core that I expected to see the foundryman have trouble. One foundry I knew had had some trouble making a set of these things, but did not know the exact nature of the trouble. Hearing afterwards that a lot had been made by the Arthur Fritsch Foundry and Machine Company, St. Louis, without apparent trouble, I went down and made diligent inquiries as to how they performed the operation—without having trouble.

I was informed that they had so much trouble that they were not anxious for another job of the same kind, but that they had managed to overcome the difficulties to such an extent that they thought they could make

them again with a loss percentage of not more than one in twenty.

The first, and the main trouble, was with the core. It was supported with numerous rods runing through it cross wise of the plate, but in spite of this it would bag and float to such an extent, that thin places would result here and there, from which the plate would fail when finished and subjected to the pressure test. [It must be borne in mind that the plates had to be subjected up to "boiler pressure," after having been faced up smooth.] After some trouble of this kind the difficulty with the cores was abated in the following way:

A number of cast spools were made, marked "A" in the diagram, and used quite freely to support the core, both top and bottom. As these became a part of the plate proper after the casting was poured it became essential that these should adhere to



The Foundry

the casting, or, at least, form so close a joint that steam could not escape around them. For this reason the spools were tinned and formed the desired joint.

The diagram is an end view that shows something of the way the core was supported. It will be observed that the shape of the spools is such that there is no danger of them blowing out even though the adhesion of the tin should fail to hold them against the steam pressure; which would leave the question of the joint simply one of preventing steam leaking.

It was found, too, that in pouring there were ways and means that meant much, and experiments evolved the idea that about twenty gates were best for this kind of work. Then, when the castings were made, additional safeguards were added in the shape of stay-bolts. Holes would be drilled straight through the plate at as many points as thought desirable, tapped, and a short bolt screwed clean through. The whole plate was then planed off to a flat surface and tested; and if it failed to stand it was a loss to the foundryman.

* * * * *

The man who wrote this article ought to have had a little more experience in light work. He should have worked for a couple of months in a radiator shop. After doing so he would not have written this article, neither would he have used the clumsy and unsightly cast iron spools in making this casting.

It is somewhat peculiar that whenever a machinery molder receives a job with a few light cores in it that he should go to work and make these cores out of the same material and on the same plan he follows with heavy cores. Here is where the rub comes in. Instead of treating it as a special job requiring special treatment he plugs along in the ordinary way and then expects the world to applaud him for doing a job that a Polack molder would learn to make in two days and not think he was doing anything extraordinary either.

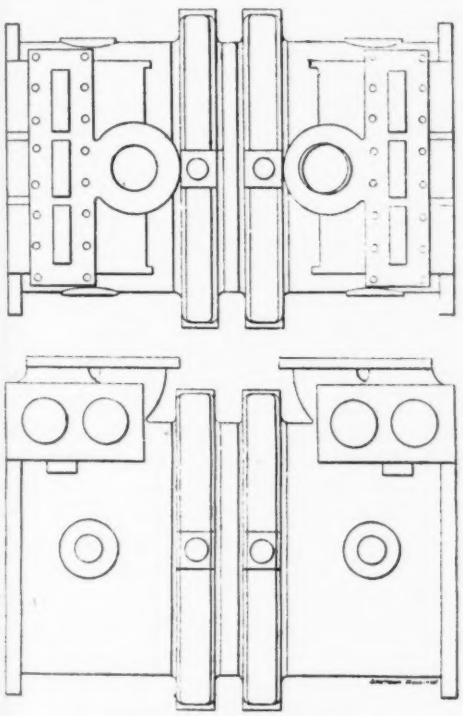
* * * * *

In making cores for the job illustrated sharp sand should be employed exclusively together with some core compound or linseed oil. There should be no more rods put in the core than what is absolutely necessary to hold the core together while being placed in the mold. Instead of the cast iron monstrosities shown the core should be held in place by a number of very small chaplets, such as are used in the manufacture of radiators. These will leave practically no mark and will be steam tight. Instead of drilling holes through these castings for staybolts, the core should be so made as to leave whatever ribs are necessary to give the casting sufficient strength. I think the whole example as illustrated by our unknown friend simply shows how much needless labor can be put on a casting and how difficult it can be made to obtain a good casting, just by going at it the wrong way.

Casting a Corliss Cylinder.

Among builders of heavy stationary engines a difference of opinion exists as to whether their cylinders should be cast vertically or horizontally, some claiming that they get better results where they are cast on end, in the way of sounder barrels, fewer blowholes, less dirt and a smaller percentage of bad castings, while others claim that a cylinder of the Corliss type is more satisfactory cast horizontally and with the valve seats vertical. Among the latter was William H. Harris, builder of the Harris-Corliss engine. Among the many styles of engines built by him for special work was a jacketed compound, with cylinders 16x48 inches and 32-48 inches. The 32x48-inch casting weighed 14,656 pounds. The small cut is a sketch of the cylinder.

I would call attention to the way of holding the jacket core by using a hollow bolt, and at the same time using the bolt to bring off the vent from the jacket core. By referring to the sketches it will be seen that there were quite a number of cores to set, and to get the gas off as it ought to be was a problem. The bushings running from the pattern to bottom board, and top of cope, were all cast with 2-inch holes through them, see Fig. 3, and when the nowel half was rammed up the bushings were placed on the prints of the jacket core, false prints having been turned, and screwed on to the regular prints, which fitted holes in the bushings, thus keeping the bushings from slipping sideways, as



THE CYLINDER TO BE CAST.

they were required to be positive, and to reach high enough for the bottom board to bear on them; see Fig. 2. In ramming up the cope the same method was followed. When ready the nowel was placed on timbers lying across a pit, as it was necessary to get under it.

The nowel half of the jacket had to be set first. Bolts made of double thick 1¼-inch gas pipe were screwed into posts of the jacket arbor, which had been tapped to receive them, and the core lowered into the mold, the iron posts of the arbor meeting the bushings, Fig. 8 *a*, as the jacket posts come to the top of the jacket prints, see Fig. 4, thus bringing iron against iron. The space, about 3-16 inch, between pipes and bushing, was next filled in with sand, Fig. 2 *d*; then a plate with a good lot of thick paste on it to fit it to the uneven surface of the bottom board was put on; then the nut on the end of the pipe was put on and screwed up, see Fig. 2 *c*, thus forming a hollow bolt, to which vents in lower half of jacket core had been brought, thus helping to hold the jacket core and at the same time taking off the vent from the lower half of the jacket. The iron post of the arbor meeting the bushing, and the pipe bolts so packed around, stopped any danger of a run-out around the lower vent.

The port cores were next set, then the center core was hoisted and run in endways between the jacket and the port cores, see Fig. 8. The top half of the jacket was next hoisted and set on top of the first half of the jacket core, and when at the right hight bolted to the lower half through the lower rib, places being left in the side of the jacket core to handle set screw or bolt, which holes were afterward filled up and dried with hot irons, the tapped holes in the lower half of the jacket arbor being used for eyebolts, to handle in setting the core, while the upper half was set by using eyebolts screwed into posts of the arbor. The mold was then lowered into the pit, resting on binders prepared for it. The cope was next tried on and found to fit all right, as everything had been correctly measured, and was then set to measure. The joint of the mold was then pasted around the outside, and the cope was put on for good, gate sticks, or sprues, being put in where green sand runoffs were to be built, and bolted down; then the joint was rammed in with new molding sand. The space between the flask and the center core was rammed up, and boards, as in Fig. 9 *a* and *b*, rubbed to a bearing. Iron blocking was then put on the ends of the flask, the binders were lowered onto the blocking, running lengthwise of the flask. One-inch bolts were then used between the binders, boards being put on, and wedge between rod and board, and nuts screwed home.

While this was being done the cotton

waste put in the bushings was removed, so that no dirt could accidentally get into the vents, and the gaspipe bolts were screwed into the posts of the jacket core through the bushings, Fig. 2 *b*, and calked around; then the large nuts were run down to the right hight, Fig. 2 *c*, on these gaspipe bolts, and cross-binders were put across the nuts, whose ends ran under the large binder. The

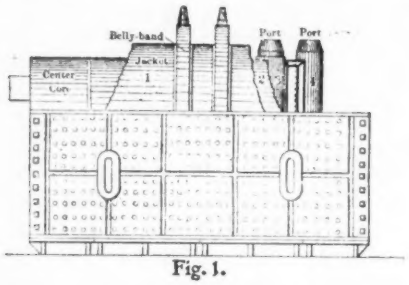


Fig. 1.

runner boxes, with the runners built of dry sand, were put in position and secured, run-offs built, shavings placed under the nowel running to the vents, rags dipped in oil were wound around the gaspipe bolts for lighting vents in cope half of jacket and ports.

Skimmers, rods to fit holes in sides of flask, where rods had been rammed up in the mold and then removed to help the mold dry sooner and vent, were at hand in case of run-out.

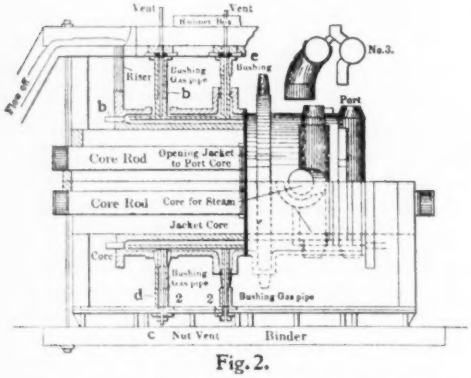


Fig. 2.

Men were told off to handle the ladles, skim, watch risers and light vent. What to do in case of accident was arranged for and pig beds built for any extra iron. Every man knew just what was expected of him and what to do.

At the word No. 1 started his ladle, and when he had enough iron in the mold to what I call cushion, No. 2 started. The iron was going in pretty lively and with the vents blazing out of the flask it looked like a small house on fire.

"Up!" shouted the man at the riser, and not a leak, not a quiver. Eighty seconds was the time occupied in pouring.

At the time this pouring was going on a 54-inch furnace was running, so there was a little to do for a foreman. Yet if a man plans his work, and keeps ahead of it, and does not let his work get ahead of him, he can handle considerable. Some of our heats ran to 26 tons. It needed, with men on the cranes, twenty men to pour that cylinder. It was churned on the two end flanges and on the port boxes, the men skimming taking the ports and the men lighting the vents the flanges, and let me say that I want the risers to any piece, whether made in dry sand or green, if of any weight, or, if a small finished piece, kept covered while pouring.

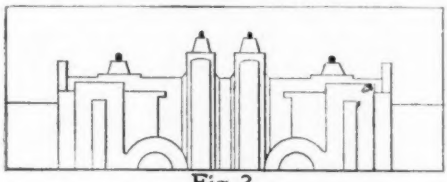


Fig. 3.

The cores shown in Figs. 2 and 8 were for holes used in breaking out the jacket arbor, which was cored around the ports, and was first broken by downward blows; then the arbor was easily broken out. These cores were first set to a gauge.

The plate on which the jacket core was swept up, see Fig. 6, was of iron, with a half circular plate, measuring the inside diameter of the jacket core, bolted on to it, see Fig. 7 *a*. Around this was a flange, the height of the thickness of the jacket core on each end, while the belly bands of the jacket core were formed by flanges, Fig. 6, 1, 2, 3, 4. In mking this core the jacket arbor, Fig. 5, 1, was placed on plate, the two end flanges being bolted on; ⅜-inch rods for vents were run under the arbor, Fig. 5, 6, through holes in flanges, Fig. 7, 1, the sand rammed around and struck off, using strike, Fig. 10. The flanges for forming belly bands were next bolted on (see section core arbor, Fig. 6, 1, 2, 3, 4), and cinders and straw used to connect vents where the rods

were, with holes in ports of jacket arbor, strike *F* being used on these flanges. The prints of jacket core were made up largely of rags covered with very thick blacking, and some fine sand, wound around the tops of the iron posts of arbor and formed with core boxes in halves *K* and *B*. You will see on the section of jacket core arbor, see Fig. 8, 2, a lot of points cast on to jacket arbor to carry belly band. After placing on carriage to run in oven the vent rods were removed, and when dry, after being blown through with bellows, were stopped up, care being taken in making jacket core that no vent should come near the surface, to have a run-out. The jacket arbor is not blunt on the ends, but beveled to an edge, and kept away some 1¼ inches from ends of jacket. I figured, as the length of the jacket was 72 inches, the expansion of the arbor would be not less than ¼ inch on each end, or at least ½ inch in all. Taking that fact, with the shrink of the cylinder itself, the 1¼ inch was left so the bevel edge of core arbor would have a chance to be forced into the sand, and not have a blunt edge to help hold against the shrinkage of the casting. Also do

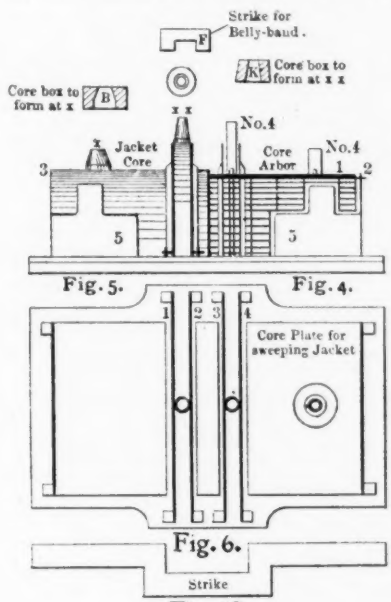


Fig. 10.

not cramp the vent; a free vent is a blessing, but a cramped vent, if it does not make a curse, it is a curse. Remember straw, also cinders, are very useful in forming channels for vent.

I used for rods some very heavy ones cast purposely with lugs or arms on the sides for the center core, which being 9 feet long by 31½ inches diameter, was quite heavy, and the core was bolted together in center, Fig. 2, 5.

Fig. 7.

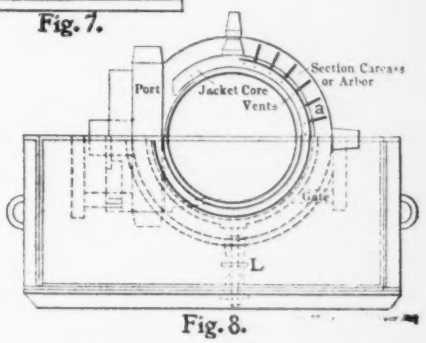


Fig. 8.

While I like a cast iron barrel with prickers to make a center core of cylinder on, would say don't let the prickers, or lugs, or whatever you may call them, come too near the surface. Remember your cylinder will be shrinking by and by, and if it binds too hard you may get a cracked cylinder; also your core barrel will expand. If you don't believe it, look inside the barrel after the cylinder has been cast a short time. Thickness outside of jacket core, 1¼ inches; 2 3-16 inches nowel side, 2 inches on cope on barrel of cylinder.

Iron used.....4,695 Carwheels
Charcoal iron .....4,910 Copake 4
Charcoal iron .....4,910 Copake 3
633 Scrap
920 Cram, 2 plain
3,025 Powelton, 2 X

Some other work took the iron remaining over; had 17,000 in two ladles. The above mixture was perfectly satisfactory, the cylinder boring out good and clean, and pronounced just right for hardness. Any foreman accustomed to the above kind of work is always glad to hear "Bored out all right!" and "Just hard enough!" which is a point it is hard to always determine. I never received a new lot of iron but I was always watching the first few casts. A number of times I have heard men say: "I

mixed the iron just the same as in the last of that same size cylinder. I do not see why it should come any harder." If he goes and looks at the pile of broken chilled carwheels he will find the chill running deeper in some than in others; the deeper the harder, and in others, maybe, particularly if Southern wheels, the little fine lines, or legs as we term them, which should run from the mottled iron next to chilled face into the gray iron, are not very distinct, and the wheel has the appearance of having nearer two distinct kinds of iron in it, or rather the line is more distinct between the chilled face and the gray iron; not as it should be.

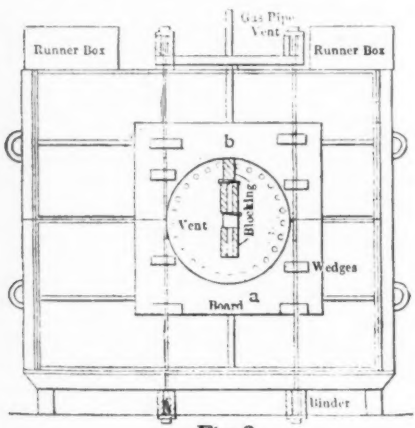


Fig. 9.

When having such wheels as the first named I put them into other work than a cylinder, as I found that those wheels, where the line of separation between chill and gray was very distinct, and with an absence, or nearly so, of the fine legs referred to, did not make as perfect a mixture as the second class named, which, by the length of leg, would show a good mixture of charcoal iron.

In making cylinders, in dry sand especially, it is the rule to have quite a joint fin next the cylinder casting to avoid any danger of crushing when the mold is put together. A mold made of green sand c common molding sand will give a little, while a dry sand mold, after being dried or baked, is a hard, porous mass, and if the upper half rests, or bears, too heavily on the under half a crush is the result; hence greater fins on castings made in dry than on those made in green sand.

It is this fin, and the fins generally, which the foreman is very apt to look at to judge something as to the hardness of the cyl- der.—R. H. Palmer in American Machinist.

Cylinder Metals and Journal Bearings.

From reports presented to the Master Mechanics' Association we take the following questions and answers thereto:

Question—Please give the committee what you consider the best cylinder mixture for your heaviest high pressure engines.

The replies to the question can be arranged in three groups. The first group containing the largest number of replies is from roads which do not operate their own foundries, and they give the uniform specifications, a close-grained iron as hard as can conveniently be machined and prevent castings being subject to shrinkage cracks.

In the second group we have those who operate their own foundries or who purchase cylinders on guarantee to meet specific composition, such specifications calling for various grades of new iron and scrap.

In the third group we have those who have advanced a step farther and added to their specifications the use of a varying percentage of steel scrap with their iron constituents. Roads using specific mixtures as detailed can only be cited as an illustration of the best practice in different parts of the country where the different special irons are in convenient freighting distance, and a universal mixture would be an absurdity. The nearest approach to universality would be a mixture of irons that would give a certain chemical analysis which practice had determined would give the best results. The data at hand, however, is too limited for the committee to go any further.

In this connection it seems to be a general complaint that some of our locomotive builders make their cylinders entirely too soft, presumably for the purpose of facilitating and cheapening the cost of machining, and also assisting in preventing a loss of cylinder castings due to shrinkage causing cracking.

Question.—Do you or do you not get any advantage in casting cylinder saddles separate from the cylinders?

The deduction of the committee from the

replies to this question would be that cylinders and saddles in one piece can be so designed, molded and handled in the foundry as to give perfect satisfaction and still be so secured to the frames as to be immovable, resulting in economy, not only as to first cost, but in cost of maintenance, although one road has been for the last two years using the three-piece cylinders and saddles, and from observations made at different times it seems they are having great success not only in keeping the cylinders secured, but they have been able to reduce to a minimum the time in which to apply a new cylinder. The method pursued by this road allows a different metal to be used in the cylinders than that in the saddle; plainly speaking, a hard metal can be used in the cylinders and a softer metal in the saddles. This arrangement seems to have advantages over the two-piece cylinder and saddle.

Question.—Please give the committee the best alloy for various bearing metals on your heavy and fast passenger engines.

The question of proper bearing metal for heavy fast passenger service is an important one, but it would seem from the various replies received, each one having good success with their own mixtures, that it is a question for each road to decide, after taking into due consideration designs of engine, weight on square inch of bearing surface, road bed and ballast conditions, methods of oiling and quality of lubricant used.

Undoubtedly one of the best metals for locomotive bearings and connecting-rod boxes is what is known as "phosphor-bronze," "S" grade:

Copper	79.70 parts.
Tin	10.00 parts.
Lead	9.50 parts.
Phosphorus	.80 parts.
	100.00 parts.

The reason the above mixture is far superior to any other is owing to the fact that copper and tin phosphorized gives it a greater affinity for lead, by which it will be understood that by the method of phosphorizing employed copper is made more fluid and in a manner cleaned, which causes it to amalgamate with the lead, and lead being a natural lubricant it has its advantages in the mixture by being held in solution, and in case of a bearing becoming neglected regarding oil for a short period, the lead in a manner fulfils the want of oil.

In conclusion, the committee would state that no matter what the mixture may be, foundry practice assumes almost as important a part as the mixture, to prevent hot bearings, and should be given careful consideration.

Stripping Plates.

Stripping plates may be used to advantage with a certain class of loose patterns. Fig. 1 is a square pully frame 10 by 4 inches deep, fitted with stripping plate and running gates attached.

The drag part of flask is placed on stripping plate as in the first illustration, filled loosely with sand and tucked well round the outside of pattern, the inside being left as loose as possible. The drag is next scraped off and rolled over, pattern rapped with bar in hole A, Fig. 2, and drawn out of mold,

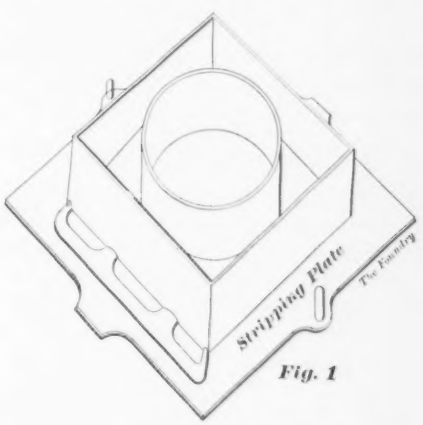


Fig. 1

leaving stripping plate on joint, which is then lifted off, leaving mold ready for top part.

The second figure shows pattern drawn and stripping plate left on joint.

The pattern is provided with two staples cast on back of pattern. These serve to draw the pattern by and also as stands on which the pattern rests when being rammed up. Four Snugs, marked B, are also cast on pattern, on which stripping plate rests in its right position. The top part is rammed up on a separate plate, so that a number of drags may be put down first, before starting on the copes.

The difference in production effected by the use of stripping plate in this instance

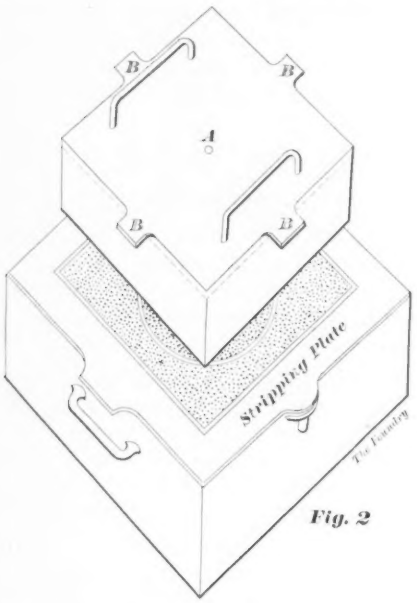


Fig. 2

being: loose pattern one, with stripping plate two and a half.

GEO. BUCHANAN.

Tricks of the Trade.

Malleable iron is being sold as cast steel for small castings, and the fraud as discovered recently in the department of tests of one of the large railroads, is interesting. A casting bought as cast steel, and for which the corresponding price was paid, was accidentally broken and the fracture was that of malleable iron. Complaint was made to the makers and the part returned as proof. This brought indignant protests from the manufacturers and the sample was returned to the purchasers, but the appearance of the fracture had changed and it then looked like that of tool steel, so fine was the grain. This transformation interested the test officer of the road to the extent of a patient invesigation, which revealed the fact that the fracture of malleable iron may be changed to that of very hard and fine steel by heating and chilling. By doing this, fractures at one end of a piece of malleable cast iron may be so much like that of fine steel as to deceive even the expert, while that at the opposite end is the characteristic fracture of malleable iron.—Am. Eng. and Railroad Journal.

How to Become a Foundry Foreman.

BY AARON FRANKENHEIM.

To become a successful foundry foreman requires a knowledge of metallurgy, cupola practice, and one must understand the different branches of molding thoroughly; consisting of green sand, dry sand, and loam work, and above all, the method of handling men, so that their services will be profitable to their employer.

I have come in contact with foremen who were not such very good molders, but they understood the theory of the trade thoroughly. There were far better molders in the same shop, but these foremen could impart their theoretical knowledge, and in turn give them a point or two. They could also handle their men to the best advantage, and as they understood the theory of cupola practice, they were right at home when it came to taking off a heat.

One of these foremen was a very young man, having served his time at pattern-making. While working at that trade he would occasionally take a stroll through the foundry and see what was going on, always keeping his eyes and ears open. When any large work went on, he would make sketches and discuss the easiest way to mold it with those working on the job. This young man soon became liked by the molders, and even the foreman, for in all his discussions he always spoke intelligently, and his sound opinion was admired by all. I often heard him say that one of the days he would become a foundry foreman, and he did.

It is plain that this young man could not have reached such a high standing among his fellow shopmates if it were not for study. He would purchase books on metallurgy, molding and cupola practice, and after his day's work in the pattern shop, he would study at night and in the cars, as he went to and from the shop, never neglecting his work in the shop.

At present there is a great fault among the majority of molders in that they will not study the theory of their trade. Somehow I cannot account for it; it is either that they are played out by their day's work or they are perfectly satisfied with their positions and have no desire to advance.

Even apprentices in the foundry do not

seem to care to study, and it is too bad for a young man to thus let his mind grow dull. It is very wrong for a foreman to put an apprentice on too hard work, for it draws the ambition clear out of him, and consequently his future is ruined, if he does not take to study, for this occupies his mind and tends to develop it.

I say for the benefit of apprentices, and molders, that they should read scientific books pertaining to their trade. They may be borrowed from most public circulating libraries. But in small towns where they cannot procure such books, they either have to suffer the consequence of doing without them or they have to purchase them, thus involving considerable expense, though it is money well spent.

In some large cities it is difficult to locate a library having them. Some time ago I inquired at a few of the public circulating libraries why they do not have such books, when the librarian told me that the majority of the population are not interested in such works, and that was the reason they did not have them on hand. I would recommend that large works and foundries purchase a complete set of such books, and issue them to the men in their employ. It will certainly be of great benefit to the molders, as well as to their employers.

On the other hand, as regards the education of molders, I have come in contact with some very intelligent men. They have certainly devoted their spare time to study, and have learned mechanical drawing. This subject is very important to a molder if he wants to better his position. I do not recommend it for the simple sand pounder who feels contented because he has put up sixty or seventy boxes of sash weights for a day's work, and then goes home with a trowel sticking out of his pocket and thinks he has mastered the art of molding. Oh, no, it is not for him; it is for those men who strive to get ahead; it is for those who possess ingenuity, integrity, self-reliance, and ambition.

For example, there is a large cylinder to be molded in loam; it is very often the case that the drawing will be shown to the foreman or the molder on the job. It will fairly rattle these people if they do not understand it, being as it is just like Latin or Greek to them, and they would have made better headway on the job if they had never been shown the drawing. On the other hand, if a man who understood drawing worked on the job, he would read it fluently and have his sweep and steam chest set, and would know where every core belonged, while the other fellow would be fussing, tinkering and trying to find out what it all meant.

It will readily be seen that the foreman will like such men who can do a job without bothering him, and keeping him from devoting his time to the rest of the men in the shop. Mechanical drawing means business, and the molders who understand it may command higher wages, and act as foundry foremen.

Returning to the subject once more, when the firm needed a foreman to take charge of their foundry, a member of the firm looked upon this young man as fit to fill the bill. He could easily see by the young man's ambition, and by his eagerness to get ahead, that he would make a success as a foundry foreman. This move of the firm in selecting a patternmaker as foreman of the foundry stirred up a lot of comment among the molders. But this did not last very long; he soon showed his capability, and through his diplomacy he won their good will. He handled his men to perfection; not alone did he increase the output but the expense of turning out the same was also lowered.

The molder's chances for advancing to a foremanship are very large; they are much better than a patternmaker's. Having constant practice in the foundry, he may easily qualify himself so as to command higher wages. But he must keep his eyes and ears open; when any difficult work is going on he must watch the process closely, for it may never be made again in the same shop. At dinner-hour he should join in a discussion with the rest of the men, for they are always bringing up easier methods for molding patterns. When asked what he thinks of the job, he should cheerfully render his opinion. It is through these little discussions that there is so much learned.

After he is a competent molder and understands the different branches, and is able to do a fair day's work, he has large chances to come to the front. Certainly he must have read books on cupola practice, metallurgy, and learned mechanical drawing. After going through all this study he ranks

with the general run of foremen, and may easily find a position as such if there is no opening in the shop in which he is employed.

Although I know of old, experienced foundry foremen who have never read any books pertaining to their trade, and still in all they have progressed, and have handled their men to success, these men are rare cases, and if a young man is not up to the times he is not in it. It stands to reason that an apprentice nineteen years old knows as much as a man of thirty-five if he has studied. It pays an apprentice in his early years to study and learn all he can, for when the days of brute strength in a foundry have gone by he will play his part.

In order to gain the good will of the men under them, foremen should treat all equally. Do not be too familiar with the men under you, be sharp, firm and persistent, and show them that you are running the shop, not they, and you will always be respected. Do not have any favorites, for this makes the men ugly, and excites a good deal of comment. Devote some of your leisure time to the apprentices, advance their salary when they deserve it, as well as that of the molders. It makes them feel that their work is being appreciated and that they are something of a success at the trade.

Stripping Plates.

It seems that something may with propriety be added to a statement made by Bolland in his supplement to "The Iron Founder" (1893) regarding the stripping plate, which is such an important feature of most of our common molding machines. In saying that "some of the first were made over thirty years ago by a large manufacturer of cotton machinery in Oldham, England," he does not tell the whole story. David Brown, of Baltimore, seems to be generally credited with being the first to make a practical machine for large work employing this feature. His machine was used for molding pipe horizontally and, according to Dingler's Polytechnisches Journal, was introduced into England by Behn in 1855 and, being improved by him and Waltjen, was widely known on the continent as Waltjen's pipe molding machine. During the next four or five years several similar machines for molding pipes, hollow-ware, etc., were produced by Johnston and Warner in this country, Viry in France, Howard, Downie and Johnson in England and Brown in Scotland.

Machines for molding pipe vertically, employing the equivalent of stripping plates, had been used in England since 1848, and Abial Elliot, of Philadelphia, had patented in 1843 a machine for molding cannon balls and the like, which was provided with a plate or collar for the pattern to be projected through, though he did not mention withdrawing the pattern from the mold through it.

Another authority, Karmarsch (Handbuch der Mechanischen Technologie), makes the statement that the stripping plate was first used in a device made for the Hanover High School in 1831-32. It consisted of two plates of sheet metal, cut out alike to the shape of the pattern (which was solid) and placed between the two half flasks. After all parts were in place and the sand pressed about the pattern, the cope with its plate was lifted off, the plate supporting the sand, and then the pattern was drawn from the drag by hand through the other plate. This crude device was used for molding tacks with large heads by an English engineer named Holmes in 1838. This was not the first use of the stripping plate, however, for Maullin, a screwmaker of Cosely, in the County of Stafford, produced an organized machine for molding screws, employing a true stripping plate of brass as early as 1800. This machine was improved by Watren in the early 40's.

In molding nails and spikes in those days the patterns were withdrawn lengthways and naturally the stripping plate was of service in such work, as was discovered by Holmes, and was applied thereto in complete machines by Onion in England, and Paing in France in 1841. The latter also provided his plate with perforations for the vent wire and gate pins to be stripped through.

It is thus seen that Mr. Bolland might have added several years to his thirty.

A. E. Fay.

One Feature of Boom Times.

When the market goes up, those who have contracts for future delivery are, as a general rule, very persistent that the last pound of material shall be laid down at the price originally stipulated. But, when the market goes the other way, many of these same

people will countermand orders and repudiate their obligations. Referring to this feature, a manufacturer of hardware specialties says:

"We have in view a contract we entered into with a responsible house in the West to furnish them during the year 1900 two hundred tons of small castings, with an option on their part to increase it to 400 tons any time during the year. They guaranteed to furnish us with patterns to employ thirty-five to forty molders at least without a doubt. We signed this contract in good faith, and immediately placed our order for iron and fuel supplies to fill it during the year at the then prevailing high prices, and turned down other offers for the year, which we could have had at as fair a margin.

"With this contract on our books in connection with our own line of goods we had provided all the work that our two foundries could fairly turn out. After we had incurred a very considerable expense for taking care of this work and putting ourselves in a position to fulfil the contract and had shipped about twenty-five tons of the castings, we received a letter from the contracting firm requesting us to return all of their patterns, as they wished to discontinue making their work from these particular patterns, but would furnish us with an equal number of patterns made from new designs. This we did at once and the result was we have been unable to get the new patterns, or even get any satisfaction from them, except that they are unable to get out the new patterns in time for this season's trade, and in this condition it still remains.

"On the other hand, we are left with a contract of several hundred tons of pig iron and fuel at the then prevailing prices, which we are unable to take in for the want of storage room, owing to the very large stock on hand already and for lack of the capital to carry more, owing to the great decline in prices and volume of trade.

"In an instance of this kind, what can we do but beg our friends to withhold further shipments until such times that we can take it in, although we could now buy iron from six to eight dollars per ton less than contract prices?

"Yet we feel in honor bound eventually to take all we contracted for at whatever prices attached to the contract. But what should be done with the other side of the question? The parties are responsible, and in fact financially more able to stand the loss (if any loss would occur to them) by taking the quantity they contracted for than we are to take the material we contracted for on the basis of their contract. Yet they simply ignore all appeals to them by mail. There are but two ways out of it, the one by exposure and the other by law, neither of which we have as yet determined upon."

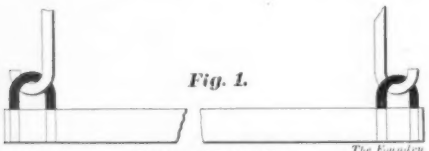
Southern Iron.

The Southern iron situation last week was but a reaffirmation of the conditions of a week before, with the exception that it has been ascertained beyond doubt that the Southern furnaces have booked for export in the neighborhood of 100,000 tons. It is divided between the leading trunk lines and the ports of New Orleans, Pensacola, Charleston and others. But the grave fact which the Southern furnaces have to front, as touched upon last week, is that, for the time at least, according to the very best authority, they have been driven South of the Ohio river and are curtailed to Southern domestic and export trade. All the export trade booked to this time amounts to no more than a month's output of the Alabama furnaces. At the same time, these furnaces have run out of the domestic orders billed a year and more ago, and very little new domestic business is coming in. The furnaces, therefore, see themselves confined to a total export business for the remainder of the year of one month's output and with little domestic business. One cause of the shrinkage of domestic business is the large increase in the cost of manufacture. When iron took a start toward higher prices eighteen months ago every class of labor in Alabama demanded an increase in wages and got it. This increased the cost of manufacture from $6.50, the lowest cost, to almost $10, the present cost. The Southern manufacturers realize that they are in a tight strait, and freely confess it. One of the leading manufacturers said the other day: "We may as well confess it. We are driven back of the Ohio. Last month we sold two-thirds of the output of our furnaces, but it was for export business, and moving it depends upon the amount of ship-room offered and many other contingencies. The export business is very uncertain. The utmost we can move with the number of bottoms offering, as a general rule, is 200,000 tons a year. That will not keep our furnaces going with no domestic trade except what we have at home. The home trade is not large enough to make up for the loss of the trade North of the Ohio river." There are said to be many inquiries for domestic transactions, but the Southern furnaces cannot see their way to take them on the basis of price on which they are based.—American Manufacturer.

Pit for Heavy Work.

BY THOS. L. AUSTIN.

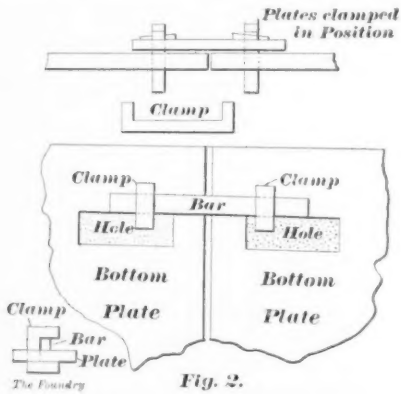
A well rigged pit for heavy green sand work is an advantage over the too common practice of digging a hole in any old place and weighting the cope down with anything



that comes handy, afterwards frequently discovering, when the mold is poured, that you have underestimated the strain on the mold in question, or could not get weights enough, with the result that it takes extra time to chip the casting.

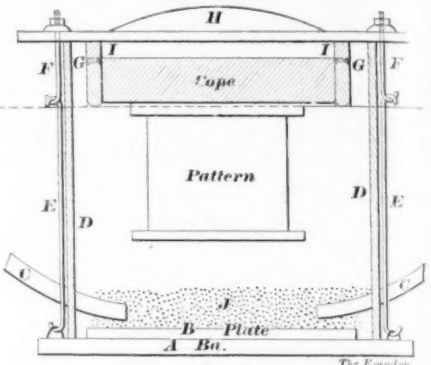
When getting up a rigging for a pit, make everything large and strong enough for the largest piece you expect to make in the pit, as the same rig will do for smaller work also.

To start with, dig the pit about two feet deeper than any pattern you intend to mold in it, and of a length and breadth to enable you to put the binder bars and bottom plates in position; these will extend beyond the pattern and cope. Bottom binder bars should



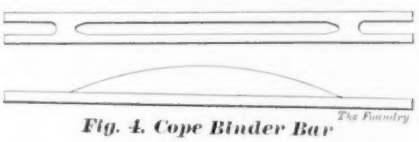
be cast about four inches square, with a heavy staple, say three-quarter inch, of wrought iron, near each end. Fig. 1.

Lay these transversely in pit, level up, and ram the sand solid, even with the upper surface, then lay the bottom plate on this. Should it be necessary to make the bottom plate in two or more pieces, the parts may be clamped together in the manner shown in Fig. 2. The bottom plates, Fig. 5, should be as wide as the cope, and nearly as long; two inches thick with several holes through them,

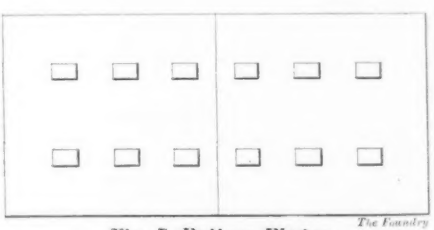


say 4″x8″ in size, some of which may be used in clamping the parts together if more than one plate is needed. Clamping the parts together makes the plates as rigid as though cast in one piece.

Rods one inch thick, with a hook on each end, and long enough to reach the floor level,



are now hooked in each staple in lower binder bars, E, Fig. 3, and inside each of these is also placed a plank, resting on either bar or plate, long enough to reach level of floor, D, Fig. 3. Size of plank 3″x10″. A good, coarse cinder bed is next put on the bottom plate, 6 inches thick, and vent pipes placed



in position, J and C, Fig. 3, the whole covered with straw, and sand rammed up to the proper height, when everything is ready for the pattern.

The work so far is permanent and should be well executed, as no necessity for disturb-

ing it is likely to arise. After the mold is finished and the cope is on, short pieces of plank are placed on those rammed in the pit, and reaching a little higher than the cope, G, Fig. 3. On these lay binder bars with slotted ends, Fig. 4. Rods with hook on one end and thread on the other are passed through slots on the bars and hooked onto rods rammed in pit, washers and nuts put on and screwed down tight, F, Fig. 3. When blocks are placed on the cope and wedges under binder bars the job is complete. This rig is very satisfactory, will hold any strain that can be put upon the mold, and is safe, neat, quickly and easily arranged.

The Position of Molders.

BY P. LONGMUIR.

Molders and all foundry-workers are not human in the sense that the patternmaker or turner is. These latter gentlemen are of a much higher calibre; they have a greater mental capacity, and in their own estimation a much higher social status than the molder. Indeed, the latter would never, in his highest flights of fancy, dream of aspiring to the same platform as that occupied by the turner or fitter, erstwhile engineer. But why is this? Is it that the molders' trade is not so skillful as that of patternmaker or fitter? The best answer to this question is to look over a large cylinder casting, examine the set of such for a 6,000-horse-power marine engine, and at the same time take a glance at the condenser castings. These castings will answer the question as to the mechanical difficulties the molder must overcome in constructing such molds, and are convincing proofs that after all there is a difficulty in attaining a thorough knowledge of the molders' art. Difficulties then are not unknown in the foundry, and if the brains are developed by overcoming them, then the staff of the foundries should present a very favorable contrast to that of the machine shop.

The uncertainty of foundry work is the great drawback of a molders' life. The smith, turner, or patternmaker see the result of each step of their work as they progress, and error can, or ought to be, readily detected. Not so with the molder. He sees the result of each step of his work in the finished casting. False steps are seen when too late to rectify them with the possible consequence of several days' or even weeks' work being lost. It is evident then that every stage in the construction of a mold must be carefully and thoroughly gone through, and nothing must be left to chance. The necessity for this thoroughness ought to produce a set of thorough-going men; does it do so? As we examine the "personnel" of our foundries, do we find this thoroughness? Do we find molders, as a class, anxious about the work they are engaged on or mastering the difficulties of their trade by individual study? In no sense can it be said that we find this spirit. Rather do we find, taking molders as a class, men of inferior tastes, little or no ambition, and those of us who have worked up and down the country, how often have we not had for "mates" wife-beaters and deserters, ex-thieves, and, by jove, if your tool box be open, present thieves, too. How often have we not lent a man a dollar to tide over some trouble, and how often has that "trouble" turned out to be a little "spree" of his own?

Molders are certainly to blame for the very inferior position in which their trade ranks among the mechanical ones. They do not seek to improve its status; they make little or no endeavor to master its intricacies, and they put too much faith in the Godess of luck. "Oh, risk it!" This is the way they get through it; risk when there should be none, through a man's inability to rise to the height of thoroughness demanded by his trade. The excuses put forward for wasters, were it not for their aggravation, are at times amusing. "It scabbed," "dropped out," "metal too hot or too cold," "too hard" or "too soft," "drawn," "blown," etc., to all eternity. We are all familiar with these excuses, and they are always given as though a scab or drop-out were things entirely beyond the molders' control. It is quite evident then that before our trade can occupy the position it is justly entitled to an alteration must be effected in the members of it. They must rise to it, master difficulties, study failures and learn the lessons they teach. The position must be made and maintained, and this object should be made the earnest aim of every molder.

Spare time could be profitably employed in studying the subjects likely to throw most light on the difficulties of foundry work. Observe the methods followed by good molders; study closely the ar-

ticles bearing on our trade which appear from time to time in the technical magazines, and get hold of all the literature possible treating on foundry practice.

A study of this kind will give a good grasp of the principles underlying many foundry processes. It will fit one to tackle difficulties, as they turn up, and the cause of failures will be better understood.

It will be argued that any system of evening study is too exhausting for young fellows who have been hard at it all day in a foundry. No doubt it is hard work, but then hard work seldom kills, and the fellow filled with ambition to master every intricacy of his trade will not grudge a little hard work.

This plan adopted by bodies of molders in all important foundry centers would, in the course of a few years, revolutionize foundries and foundry work. We should have an intelligent class of molders whose aim would be to improve their work, and at the some time the position of their trade. This class would in time become the leading one among molders, and it would gain for the trade a status worthy of all that is best in it.

New Orders Coming.

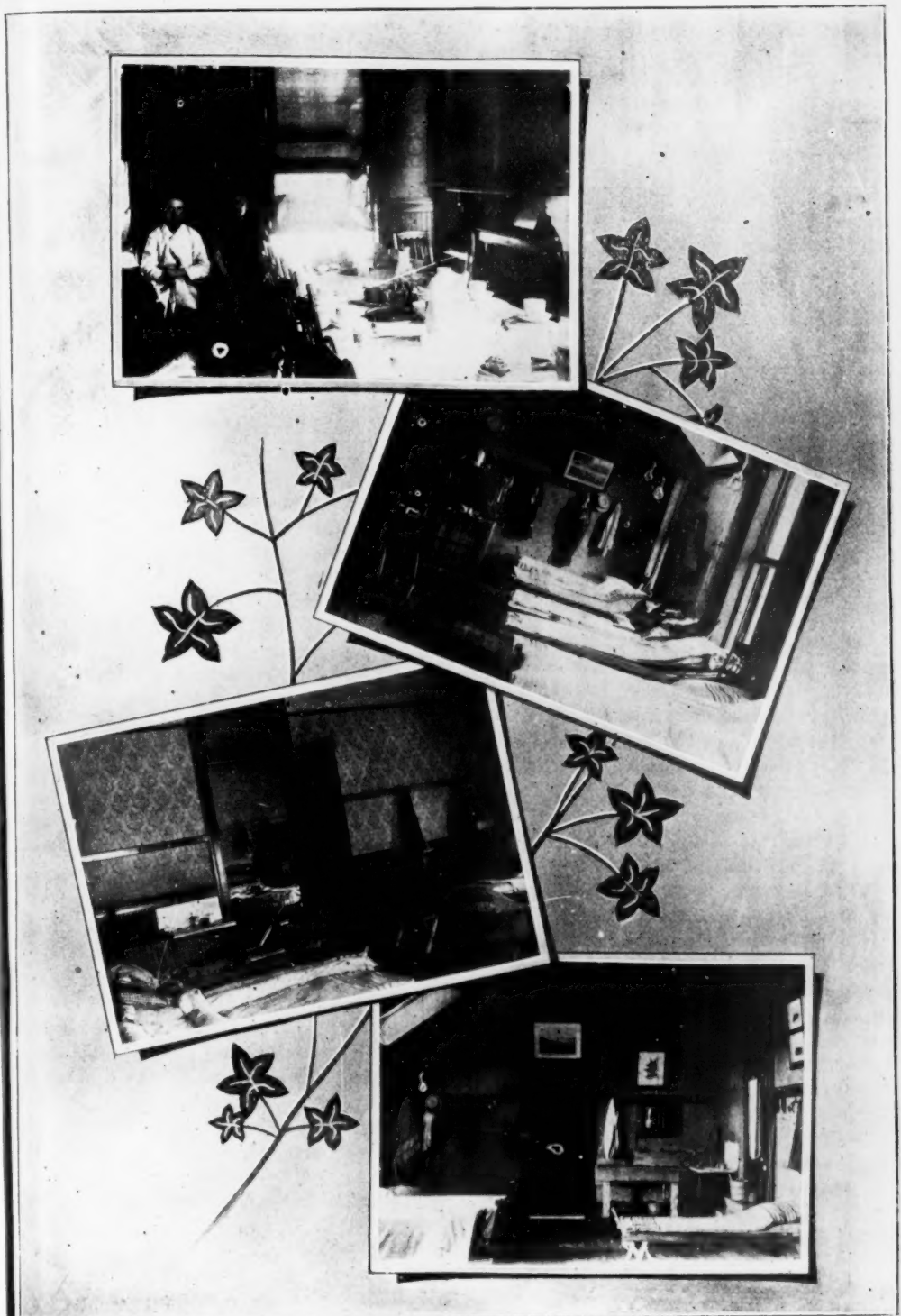
In a domestic way, too, the pig iron business is showing signs of more activity. Prices are still low, of course, but Cincinnati firms report that the demand for iron to go to the large foundries and mills is larger now and will show larger for August than for months previous. The way in which the orders come in shows that the concerns are practically down to the bottom in their supplies and have to have the iron. They send in the order and then ask for its prompt shipment and follow up with the request that the iron be rushed, and keep in a stew about it until they get the iron on the ground. It has been a matter of wonderment, too, to some of the pig iron men and foundrymen how some large concerns have been going as long as they have without being in the necessity of making contracts for more castings. The foundrymen recall that last year the concerns bought an enormous amount of castings and seemed in a rush to get them and could not have them delivered fast enough. Suddenly the demand for castings, on such contracts as were unlimited as to amount, began to drop off after such spurts as these, and the concerns have in many cases not been doing any buying since. The drop from such a great lot of castings to few, if any, has been so great that fear has been excited in some cases that the firms had overreached and had made up too large a stock. But recent events have explained the situation, as shown by the instance of at least one large local concern. The concern took a large amount of castings and kept at the foundry all the time to deliver more. A big business was done, too, but not such a business as would take all the castings bought, and the result was that the concern was able to lay in a large stock of castings at the low contract price and run along with these castings without making a new contract or buying more. This is now coming about to an end. These supplies of castings laid in by various concerns are running out, and they will have soon to make, or are now making, contracts on a new basis. This is another way in which the pig iron men account for the largely increased volume of the business at this time.—Cincinnati Enquirer.

Some Features of the Molders' Strike in Cleveland.

The molders' strike in Cleveland, which has been in progress for three months, is being carried out on both sides with all the originality at the command of the respective organizations.

There has probably never been a large strike in which such a small amount of violence has taken place as during the present fight at Cleveland. No matter what one may say of the motives and principles which prompt the molders of that city to wage their present contest, these men are at least entitled to be complimented upon their perfect discipline and the almost entire absence of unlawful acts which has too often disgraced the struggles of organized labor.

As a general rule, there is a very bitter feeling between those who strike a shop and those who take their places, which generally ends in open conflict. The National Founders' Association, at the beginning of the strike, recognized the possibility of friction, and in order to do its share towards avoiding same, the Cleveland members have, in the majority of cases, provided private quarters for their new employes close to the shops, where these may be free from the



A VIEW OF SOME OF THE QUARTERS THE CLEVELAND FOUNDRYMEN ARE PROVIDING FOR THEIR NEW EMPLOYES.

annoyances which are sometimes bestowed rather freely upon a new set of workmen.

It is a very general impression, judging from newspaper articles, that such quarters temporarily provided are more in the nature of prisons than anything else. In order to divest our readers of this idea, we show herewith some illustrations of the quarters provided by the Cleveland foundrymen for their new employes. Sanitary conditions and the general comfort of the workingmen has been carefully looked after, and that the surroundings are not at all unpleasant is shown in the very small number of men who quit their jobs.

A number of foundrymen interviewed expressed themselves as highly satisfied with the workmanship of their new employes and their general deportment. Several of the shops have all the men their business demands, and but little difficulty is being encountered in taking care of orders.

The Problem of Machine Molding.*

E. H. MUMFORD, Elizabeth, N. J.

The much discussed question, how molding machines shall be used in our foundries and the reasons why there should be any discussion of the question whatever, are made the subject of what is written below.

It may be well to look at the real hard facts in the situation as the machine finds it to-day; try to find reasons for these facts and then to discuss the future of the molding machine from the basis of the present and the deductions it is possible to draw.

There are five prominent facts:

1. Molding machines have entered upon a field of work in which they have proved their usefulness and economy, and in which they are destined to remain instruments of progress.

2. Machines dispense with some of the skill necessary to the molder by the method of their working and render more of this skill unnecessary by avoiding some of the difficulties hand molding introduces, such as mending broken corners, etc. They may, therefore, be successfully worked by unskilled laborers.

3. While laborers are perfectly well able to make machines profitable, in doing this they generally earn almost molders' wages, when paid by the piece or when putting up a large day's work, and it is therefore possible for a molder to do as well for the owner of the machine and for himself as the laborer does if he will work as hard.

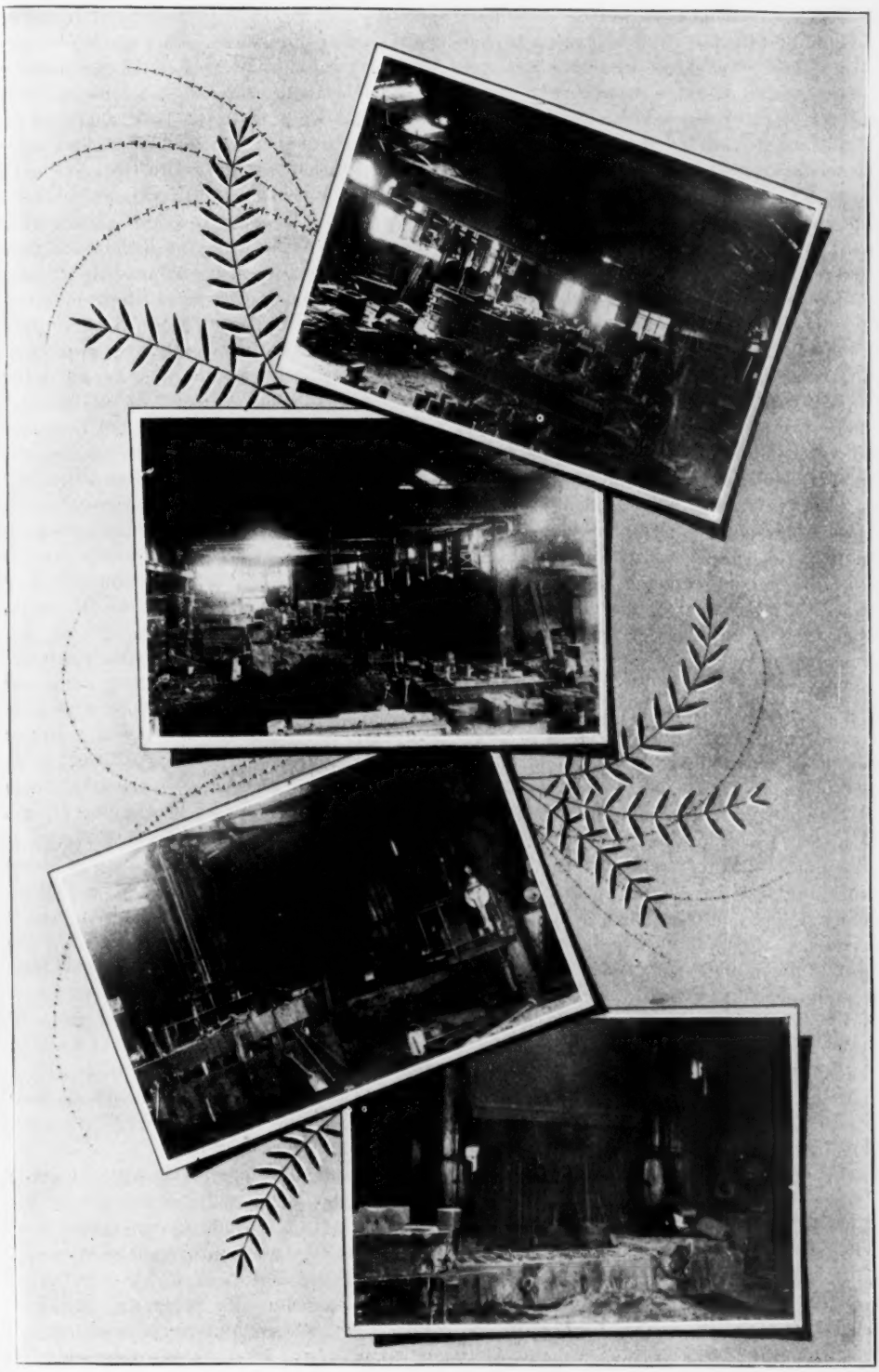
4. The molder will not do as large a day's work as the laborer on a molding machine for the same amount of money, and is therefore an expense to the owner of the machine he runs, similar to what would result if molders were to charge the cupola or run the cranes.

5. There is work enough for both machine and molder and the machine, taking as it does, the repetition work, relieves him of the monotony which the general introduction of machines is accused of forcing on the wage earning class as a whole, and owing to the speed and cheapness with which the machine turns out small parts, more of the larger and more intricate portions of machines are called for from the molder.

Another fact that is proven by statistics is that the general introduction of labor-saving machinery in the world of manufacture, while it has undoubtedly the (at least temporary) effect of displacing labor in the special field which it enters, yet increases rapidly the number employed in two other fields, namely: that where the machines are built and that which uses no machinery at all. That is, anything which facilitates the use of labor saving machinery in general, as in the textile and agricultural industries—which the molding machine obviously does, increases the number of men employed in making these machines. As the molder, most naturally, is interested in the future of his trade, he should, therefore, do everything he can to encourage machine building in general, and nothing offers a better opportunity than leaving the molding machine absolutely untrammeled in its natural progress with unskilled labor.

To say that molding machines have found and entered upon their field of usefulness rather under than over states the fact. They have partly created the field. This will be understood to be particularly true when it is considered that everything may be treated as a molding machine which substitutes a mechanical guide or movement completely for an action of a molder, thus taking over for the special case, perhaps, this action to

*Paper read at the September meeting of the Foundrymen's Association.



INTERIOR VIEWS OF THE FOUNDRIES OF THE OTIS STEEL CO. AND THE GLOBE IRON WORK PLANT, OF THE AMERICAN SHIPBUILDING COMPANY, AT CLEVELAND, OHIO.

itself. A simple illustration of a molding machine of this sort, if it had enough parts to be called a machine, would be the time honored match or follow board. This simple machine element usurps completely the very tedious and delicate operation of jointing the surface of the drag around the pattern. There is absolutely nothing of this operation left for the molder when the match board is lifted off, if it has been properly fitted to the pattern, and, add to the board a hinge and clamp so that it rolls over with the drag, or provide it with mechanism for its removal, as a crane, and, in the combination, you have a molding machine which simply joints the mold.

It is safe to say that, if every pattern had had to be jointed in a mold by hand for all the years since match boards first came into use, relatively very few duplicate castings or machines embodying them would be in use to-day. The match board, the sand match, the hand rammed stripping plate, the power rammed stripping plate, with automatic draft, the vibrator frame using patterns without expense for fitting to the molding machine, and thus rendering the most irregular patterns instantly applicable to molding machines, are all steps of progress in the creation and development of the machine molding field.

In other words, the molding machine is not a new thing introducing new problems and conditions to the trade. By the perfectly natural and irresistible evolution of its destiny it has finally reached a point of independence where it does not need the expense of the skilled craftsman.

Simultaneously with it, has come the greatly extended use of duplicate castings, the demand for which the molding machine has helped to create, so that it comes not as a beggar but as a useful and well known member of society.

The officers of the Iron Molders' Union have recently taken the stand that, to quote their own words, members of the Union should be allowed "to develop the best possibilities" of the molding machine, thus also to "control" the machine. Undoubtedly these men are perfectly sincere in their belief that these things can be done, and some attempts to prove this have been made. Now the "best possibilities of the machine" are of course those in the path of economy in its use and the demonstrations of the molder's power in this direction have not been such as should encourage him to persevere.

Some machines of the most efficient modern type were operated by Union molders in a line of work where it was, by chance, perfectly easy for the writer to make exact comparison with exactly similar machines on exactly the same work in another shop. Result: 65 flasks from the molder for $2.75, and 160 flasks from the laborer for $2.40—i. e., what was costing more than 4c in one shop was costing only 1½c in the competing shop, and I have wondered ever since if the Union seriously meant this as an initial step toward the "control" of the molding machine, as it certainly could not be considered their "best possibilities." No, the control of the molding machine will never pass from the hands of the evolutionary destiny of the manufacturing world to either the molder, the builder of the molding machine or its owner. And the figures quoted above show that machines may be made to pay without molders.

Why the molder will not work harder, so as to make the molding machine as successful in his hands as in the laborer's, is not a hard question to answer. Very little use for his hard learned trade is called for. If the molder would succeed as a machine operator, he must forswear his handicraft and strengthen his back, and there is, as he wisely reflects, no real reason why he should —therefore he doesn't. Why should he?

But why does the Molders' Union seek to control the machine? It has been implied by one of its officers that it is becoming a power which threatens the power of the organization. This is true of some shops absolutely, of some partially, and in some, as the machine is known to-day, it never will be true, and nothing except the development of the machine and its accessories can change the situation.

In the first instance, the entire work of the foundry is or will be molded by machines; in the second, the machines mold or will mold a portion of the work, and in the third, the work is of such a sort that no existing machine can profitably handle it. In the first-named foundry, no molders will be found of the kind we are discussing. In the second, molders will be found making such pieces as the machines would pay on.

and making more of those very pieces because the machines have cheapened the smaller castings, making it easier to get what probably represents the more troublesome and expensive parts of some lines of manufacture, and to get them so promptly that more of the large pieces are sure to be needed on account of improved deliveries of the finished outfit. There is thus, apparently, every reason why the molding machine, with its unskilled labor, and the molder, should form a very happy working family in such a shop, and why they do not is hard to see except there is being forced there some ulterior object foreign to the interests of the molders in that shop and foreign to the interests of the shop owner.

The only possible reason why, in a shop employing both molders and molding machines operated by unskilled labor, the Molders' Union should object to such operation of the machines seems to be this: In case of a difference of opinion between the Union and the owners of the foundry as to how (the owner would say) the shop should be run or (the Molders' Union would say) the men should be treated, which involved a strike, the foundry would not be absolutely closed, inasmuch as the machines would not be stopped, and heats would be taken off every day.

If this is the reason why the Molders' Union is seeking to "control" the molding machine, then what has been written above has no interest for the molder, there need be no pretense of an attempt to "develop the best possibilities of the machine" nor argument of the present nor thought of the future. Everything is plain and above board, as soon as this is admitted, and "control" of the traveling crane, or the water supply, or the highway leading to the foundry, would do as well.

I will not think that anyone interested in the future of the iron or brass molders' trade will do anything to impede the progress of the molding machine. I do not think even, that any employer will be deterred from introducing improved machinery such as molding machines in his foundry by any consideration except the economy he may realize from its use with unskilled labor, and I know that the introduction of the molding machine in our foundries is as certain to be successful as that of the turret lathes (to which the molding machine has often been likened) and the other automatic machines all through the machine shop.

I would close by saying that, as a builder of molding machines, I know the situation to be as I have pictured it above, and what I have written is not mere theory of a machine molding millenium, but the sober judgment of experience.

Let me further say that, in mingling with molders who have worked for me, and dealing with their Union committees, I have found them, individually, men of such good sense and spirit that I have built upon these qualities among the molders the expectation that the present rather absurd obstruction of the molding machine operated by men not molders, but men for all that, will speedily die out.

The Foundry Industry in the South.

The foundry industries of the South are segments in the same circle of industrial developments, that is crowning the country with unabating success and prosperity. It is in the propaganda of progress, in which iron and steel are among potential factors. These are constantly multiplying as enterprise puts its strong hand to the task of utilizing the raw material awaiting but the miner's pick, the blast furnace and the rolling mill. In what has been done, is being done, and will be done along these lines, we have one of the superb histories and prophecies of the new empire added to the industrial world. In iron, coal and all material auxiliary, and related to mineral and metallic products, native resources are rich and practically limitless. As mills and factories multiply, and the country becomes a hive of industry, the home consumption of native products increases, for in every added mile of railroad, and in every new enterprise from a machine shop to a cotton mill, the man who works with iron has his market and his reward. It is obvious under these new conditions that the Southern foundry has an opportunity and a destiny. It has the advantage of comparatively cheap and reliable labor, it is in close proximity to raw material, freight rates are favorable, and access to outside markets is good both by land and water. If the foundry business in

the South fails to prosper under these conditions, it must clearly be from other causes. It may not be in the present stage of development that molding in the South has reached the point of perfection in variety and artistic finish as in the North, but the trade provides the all-around molder, and the product is up to the requirements of the market. In the manufacture of stoves, for instance, the taste for the ornate or decorated article has to be cultivated. The open fireplace from colonial days has been a hereditary institution. It has ancestry and memory to prolong its existence, but in this as in other things, the world keeps moving. The stove for various practical and commercial reasons will gradually displace the traditional fireplace, and the stove manufacturing industry is likely to be one of as much importance in the South as it is in Michigan. The same may be said of other lines of molding, and castings of all kinds will be in such demand as to keep the foundry interests well employed. The molder from the North may yet find congenial employment and satisfactory remuneration in the new field now opening up to the foundry industries southwards. It is but a matter of time when this important industry will be a special feature in the activities of a country so long in the background but now sprinting to the front.—Age of Steel.

Concerning Coke Production.

The completion of between 2,000 and 3,000 coke ovens in Southern Fayette county, or the new "Klondike" region, as it is called, will present a new phase in the coke industry of the Connellsville region. These new ovens will be producing, most of them, within a year; many of them will be fired up by this fall. Their product will go to the furnaces of big consumers who are now buying their fuel from the operators of the Connellsville region. Practically all the new coke plants in Southern Fayette county are controlled or owned by powerful iron and steel combinations. Supplying only the demands of these combinations that own them, the Klondike coke plants are assured of steady work the year around.

It is the withdrawal of the patronage of the big combinations of iron and steel manufacturers who are providing for their own fuel supply, that will cause a flurry in the Connellsville district. With demand shortened in volume to the extent of 3,000 ovens' product, it will naturally follow that either some of the Connellsville district plants will have to shut down or else there must be a corresponding increase in the capacity of consumption. In a nutshell, the capacity for coke production will before long be far in excess of demand or the capacity of consumption.

The independent, or smaller operators, will be the sufferers. Coke companies and operators with no furnace affiliations will immediately feel the effect of the Klondike region's influence on the coke market. At present much of the product of firms of this class is contracted for and sold by the H. C. Frick Coke Company. It is several years since this arrangement has been in effect, though the contracts are made semi-annually and annually. The Frick Company takes the coke of quite a number of small plants throughout the region and some very large ones, notably that of the Cochran interests, at a fixed rate and steady operation, that is six days a week. Well posted men in coke consumption say it will not be long until the entire product of the Frick company will be taken by the Carnegie Steel Company. Then, with the consumers who are building their own ovens in the Klondike district out of the market, there will be considerable competition for orders and as a consequence the price of coke will come down from present fancy figures, the smaller fry will have to shuffle for themselves and at the first intimation of dullness their ovens will go out of blast.

Though it is not generally known in the industrial world the coke ovens building in Southern Fayette county are not, strictly speaking, in the Connellsville coking coal field. The regular nine-foot seam of Connelsville coking coal outcrops on the south of Smithfield, about 10 miles south of Uniontown. Beyond that, although the vein is nine feet in thickness, it is not the same coal. In the quality of the coke made there is some differences with a shade the best of it in favor of the standard Connellsville product.

It is the proximity of the Klondike field to the Connellsville district that will make of it a rival. Besides coke plants are projected even beyond the Klondike territory.

as evidenced by the purchase recently of 100 acres of coking coal lying near the Cheat river, some of it on the Fayette county side, by Bliss & Marshall, of Uniontown, owners of the Percy works, in the Connellsville district, and the pioneers of the coke industry in Southern Fayette County. Bliss & Marshall built the Kyle plant, now owned by the H. C. Frick Coke Company, which is located just beyond Fairchance. Again, they are outstripping all other operators and will build a large coke plant on the Cheat river as a connecting link between the Northern West Virginia and Fayette coke fields. With the completion of this plant there will be, practically speaking, a continuous row of coke ovens from Latrobe, 200 miles down into the Virginias. Moreover, the new Bliss & Marshall plant will be the first link connecting the North and South in industry. The plant will lie partly in Pennsylvania and partly in West Virginia.

Coming back to the Connellsville region and the over-production of coke likely to result from such extensive oven-building, it is safe to say that none of the plants erected will rot for want of sale of their product. There may be times when they will lie idle for months, but it must be remembered that the life of the central portion of the Connellsille district is entering into the last stretch of mile posts. Between Connellsville, Scottdale and Mt. Pleasant and the districts lying close to these places, there are upwards of 3,000 ovens that cannot be kept active a great many years longer. The supply of coal in this territory is ebbing away and 15 years will make a hole in it that will cause speculation among coke consumers as to where their supply eventually is to come from. Then the Southern Fayette region will be working every oven. When the supply of coal there and in other parts of the Connellsville region reaches low-tide mark, electricity may have taken the place of coke.—Raymond S. Coll, in American Manufacturer

Analyses of Pig Iron.

A complete volume of this work, compiled by Mr. S. R. Church, of 307 Sansome street, San Francisco, Cal., has reached us. It is dedicated to W. C. Herron, of Rogers, Brown & Co., who contributes the opening article on "Analyses of Iron in Mixture."

The author has made an honest attempt to obtain the analysis of every brand of pig iron made at home and abroad, and has succeeded far beyond general expectations. A number of fine half-tone illustrations accompany several of the leading brands of iron, showing their fracture and in many instances a view of the furnace where these are produced is also attached.

This is the only work of its kind in existence, and contains a great deal of information which the consumer of pig iron should find valuable as a reference. It is sold at $2.50 per copy in the United States and Canada; to foreign countries the price is 12 shillings.

Pneumatic Hand Rammer.

The pneumatic hand-rammer, illustrated herewith, is designed to meet a large variety of work in the foundry, not only on the floor but on heavier loam work, where it may be used to good advantage alone or as an auxiliary to the heavier type of pneumatic rammer, which is suspended from a crane. This hand-rammer is in general design similar to the suspension rammer, but is made light enough so that its use cannot become irksome to the operator. At the same time it is sufficiently heavy so that its inertia absorbs any variation that may arise from the rapid reciprocation of its piston and the

rammer head. There are no exposed working parts to this machine, so that dust and dirt cannot affect its operation and durability. The valve mechanism is entirely enclosed and is as simple as is consistent with proper distribution of air in the cylinder and smooth working. The rammer rod is hexagon in shape so that it cannot turn except at the will of the user. It is also arranged so that the piston will remain at the top of its stroke when the machine is stopped. The weight of this rammer is 45 pounds and it strikes 250 to 300 blows per minute, using air pressure at from 50 to 100 pounds per square inch; only 15 cu. ft. of free air per minute are consumed in continuous operation as shown in the illustration. The machine is provided with a handle on each side; to the handle on the right side is attached the air supply hose and the admission of air to the cylinder of the rammer is controlled by means of a throttle lever under the thumb of the user; exhaust air passes out through the handle on the opposite side; the speed and force of the blows may be varied at the will of the user. A number of different shaped rammer heads are provided with each machine; these are attached to the rammer rod by means of a taper fit and may be changed in less than one-half minute without letting go of the handles.

The manufacturers of this machine, the Philadelphia Pneumatic Tool Co. of Philadelphia, New York and Boston, are furnishing these machines for a great variety of uses. Besides regular foundry work it has been found to be unsurpassed as a labor saver in ramming up converter bottoms in Bessemer steel plants, and the rammers have been adopted by a great many of the largest plants of this kind in the country. The rammer has also been found useful in ramming the molds of special shapes of fire brick for use in glass and other furnaces. On any kind of work where ramming has to be done, it is claimed that this machine in the hands of an unskilled worwman will do the work of from four to six men using the ordinary devices for ramming.

The Baby Bessemer Process.

In reviewing "The Baby Bessemer Process," and an article recently appearing in a German journal concerning same, Richard Moldenke says, in the Iron Trade Review:

It will be remembered that not a great while ago strong efforts were made by interested parties to introduce into this country two French applications of the Bessemer process for making small steel castings. So far the results have not been very brilliant, for one process—the best one, by the way—seems to be dead, and the other has to contend with troubles of a kind peculiarly inherent to the American demand for success under adverse circumstances. Be it noted that the processes themselves, if completely carried out, give a uniform and good grade of steel castings, but—and here is the difficulty—they are not carried out as they should be, not even in France, as the tests made by the reviewer on the product have amply shown him. What can we expect from the American demand for tonnage made by cheap men under ordinary foundry management with processes involving the loss of about 17 per cent of the iron charged during the blow? No wonder that in this country the open-hearth steel process is rapidly encroaching on the field formerly covered by the Bessemer only. As the "baby Bessemer" processes are rapidly extending in Europe, however, possibly because they get a high price for castings there, the article to be discussed may be of interest.

From the historical standpoint it seems that the first attempt to make steel castings by the Bessemer process was made in Upper Silesia in the early seventies, thin steel plates for street paving purposes being cast direct from the converter. The process did not take in Germany until 1890, when the works at Haagen bought the rights for the Walrand-Legenisel process in Germany, and in 1896 licensed Mr. Carl Rott, of Halle, to undertake the production of Bessemer steel castings. Mr. Rott is the author of the article under consideration. England, Sweden, Russia and Austria, and especially France, went into the baby Bessemer industry with vigor. The process of Robert makes use of a side blast. Tropenas blows the air on top of the bath, while Walrand uses the ordinary bottom blast and much smaller charges than the others. At Halle, where the Walrand-Legenisel process is used, they have a converter in which about 800-pound charges are blown at a time. The iron, melted in a cupola near by, is run directly into the converter by means of an

extension to the spout. The composition of the pig iron is as follows: Silicon, 2.3 per cent; carbon, 3.5 per cent; manganese, 0.8 per cent; phosphorus, 0.07 per cent. Ten per cent scrap from previous casts is added and the melting ratio is 1 to 12½. Before the first charge is blown the converter is heated up with some coke burned under a light blast, then cleaned out and at once put into service. The process itself is interesting from the chemical standpoint, for the burning out of the silicon, manganese and carbon is to some extent regulated by the temperature of the bath attained. The iron from the cupola arrives at about 2,300 degrees F., and the converson must raise this to about 3,100 degrees F. Now neither carbon nor manganese will furnish the fuel for this high temperature, but silicon does, every per cent of silicon thus burned being equivalent to a rise in temperature in the bath of over 500 degrees F. As the temperature gradually rises the point is reached (2,550 degrees F.) at which carbon will combine with oxygen before the silicon can get it, and hence the silicon will not go quite so fast, while the carbon is reduced very rapidly. The German, English and Swedish adaptations of the Bessemer process are based upon this phenomenon. Thus the German pig irons being fairly high in silicon, there is consequently a very high temperature in the converter. The burning out of silicon practically ceases at 2,550 degrees F. The carbon now burns out, leaving about .30 silicon in the bath. Ferro-manganese being now added, the after-blow brings the bath to the proper composition and temperature for casting. The German process of Bessemerizing is therefore characterized by the high initial temperature and the recarburization.

The English process deals with irons much higher in silicon and manganese, hence it is possible to blow with an initial temperature much lower than the German. Nearly all the silicon and manganese is burnt out in the first six minutes, the carbon now goes and with it the balance of the silicon, for the burning of the carbon tends to lower the heat of the bath slightly. In 12 minutes the 3.75 to 4.00 per cent of carbon is gone, and spiegel is added to get the proper composition. In the Swedish process the irons are so low in silicon that it must come from the cupola very hot. The burning of the silicon is just sufficient to reach the point at which the carbon can go, and not enough to allow recarburization. It is therefore necessary to stop the process at the exact carbon contents and cast at once.

In the application of the Bessemer process for small steel castings it is necessary to get a very high casting temperature, and hence Walrand adds 5 to 10 per cent of melted ferro-silicon to the bath after the carbon is gone. An after-blow, lasting about one minute, is given, and then the final ⅝ per cent of ferro-manganese is added. The addition of the ferro-silicon and the after-blow results in a very high casting temperature. The addition of ferro-manganese results in a boiling up of the mass of steel, which subsides as soon as the reaction has taken place. Right here will be found the success or failure of the blow. There being little time to spare before the cast must be made (in the O. H. the metal should be in proper shape when tapped), it is difficult to get rid of the gasses completely. A test is made as soon as the bath is quiet, by pouring some of the steel into a small ingot mold. If the metal solidifies and sinks it is in proper condition; if it boils over there is too much gas left in it, and more silicon, manganese or aluminum must be added. As this is often too late the result is a miscast, which goes to profit and loss.

Mr. Rott now gives some recipes for making the molds, among which are the following: (a) 5 parts ground crucibles, 1 part clay; (b) 6 parts ground fire brick (Schamotte), 4 parts molding sand, 4 parts river sand, 2 parts clay; (c) 8 parts river sand, 1 part ground coke, 2 parts ground fire brick, 2 parts clay; (d) 6 parts ground fire brick, 6 parts river sand, 2 parts ground coke, 3 parts calcined clay, 2 parts raw clay. The material is ground fine, well mixed and sifted. It is now spread in thin layers, dampened, and let stand 24 hours. It will now ball properly and can be used at once, preferably as a facing, old material filling up the balance of the mold. The molds must be well vented and properly arranged for casting, the idea being to distribute the fluid steel as quickly as possible, so that sound castings may be the result. A layer of fire clay and graphite is now dusted on and slicked off, the molds are dried carefully

and while still hot coated with a wash of ground quartz in molasses water. Green sand castings are made in molds rammed up with sharp sand mixed with a little coal tar. Great trouble is experienced from the presence of water in the blast; this got so serious that just as the carbon burnt out great flames issued from the converter; and a burned, gassy, and weak steel resulted. After settling tanks and screens were provided this evil ceased to cause any trouble. Mr. Rott seems to have had trouble with his cupola, the iron chilling too quickly. He therefore suggests the addition of a hearth so that it can be kept hot for a long time by a species of refining. Finally Mr. Rott gives some costs which will interest us sufficiently to be given in full. A day's run of five blows of 770 pounds each, or 3,850 pounds, gave a net weight of castings amounting to 1,760 pounds. These castings cost:

For Labor—	
Melting	$ 2 40
Converting	1 60
Molds and cores	23 90
Cleaning	6 00
Labor	3 10
	$37 00
For Material—	
Pig iron	$17 36
Ferro-silicon	3 16
Ferro-manganese	2 54
Fuel	6 20
Supplies	4 44
Shop cost	11 00
	$44 70

This is on a basis of 17 per cent loss of pig iron, 6 per cent loss of ferro-silicon and 3 per cent loss of ferro-manganese, pig iron costing $19.10 per ton. The total cost was therefore $81.70, or 4.65 cents a pound. The castings, weighing from ½ pound to 23 pounds each, brought 6.82 cents a pound and over in the market, figures that are certainly of interest to us. Mr. Rott now enumerates the advantages of the baby Bessemer process over the open-earth methods, which, however, count for little with us here, as we are not over-fond of the Bessemer products anyhow, and concludes that a great future stands before this branch of the manufacture of steel castings.

A bad light-up of the cupola makes a bad heat. The bed must be burned evenly, or it will not melt evenly.—Kirk.

A Large Pulley Boss.

There are several ways of molding pulley bosses, the accompanying illustrations showing method when made in loam, rings and bars being used instead of the usual ramming up, so that the mold may be got ready for casting within an hour or so after the top plate is lowered on.

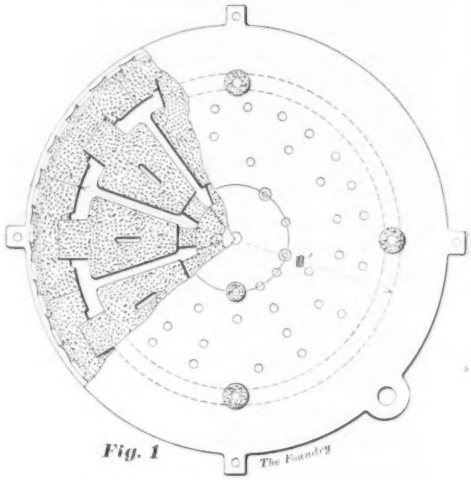
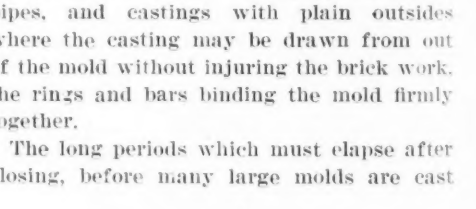


Fig. 1

Foundrymen are not unanimous as to the advantages of the ring and bar system. It is, however, used by many firms upon a great variety of work. It is always a distinct advantage where numbers are required off one casting, such as large pans, socket pipes, and castings with plain outsides where the casting may be drawn from out of the mold without injuring the brick work, the rings and bars binding the mold firmly together.

The long periods which must elapse after closing, before many large molds are cast

Fig. 2



(three or four days perhaps) is a serious matter, and the chances of the mold becoming damp cannot be ignored. With the rings and bars, however, this is entirely avoided, as are the chances of strain through loose

ramming and other mishaps consequent to unskilled laborers.

Against these advantages the fact that a large quantity of material is used up for tackle has to be taken into consideration, for as the mold increases in depth the rings are placed closer together so that in very deep molds many rings are required.

In the case of the pulley boss two rings only are used, which may be cast one on top of the other, slot holes being placed five inches apart as in Fig. 3; the bars are cast in the same way.

After the bottom face has been bricked up, the first ring is bedded on the outside bearing, just clear of sweep, where dry cores forming the sides of boss are set and the

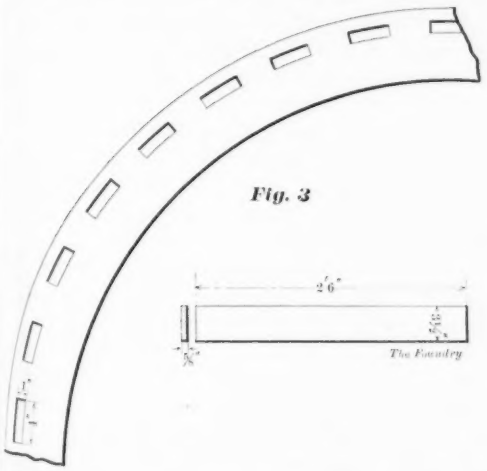


Fig. 3

joints between made good. The top ring is next bedded on the cores and the bars dropped into their slots, wooden wedges being used to keep the bars to the outside of the rings. The space between the back of the cores and the bars is daubed up with black loam and the guide for setting the top plate swept on. The top plate may be either bricked up or rammed with core sand and finished off with loam. The runner is made up before placing top plate on the mold, so that the binding together with bolts or clamps is all that is required to make the mold ready for pouring.

GEO. BUCHANAN.

Cupola Malleables.

Some of the statements made on the subject of the cost and feasibility of cupola malleables are so misleadinng that it probably causes others who are engaged in the management of the shop as well as myself, a great deal of worry as to how we are to produce malleable castings with the present price of labor, iron and other materials that enters into their manufacture, at a cost of less than 2½ cents per pound, as stated, and I should be pleased to have those who can do the trick publish the figures upon which they based their cost, starting out with pig iron and following with the other items which enter into the cost.

As articles of this kind are published, the employers of such men as myself undoubtedly hold these figures over their employes and wonder why it is that we cannot get men to work for nothing as would be necessary in this case, in order to produce malleable castings, such as are used in agricultural machinery, at a less cost than 2½ cents per pound.

I will state that for a term of 12 years I used a cupola in making malleable castings, but for the past 12 years have used the standard method of melting in a reverberatory or air furnace. Under no circumstances would I return to the old method of melting with a cupola; nor is there to-day any first-class manufacturer of malleable castings who pretends to use a cupola. As regards the matter of shrouding the manufacture of malleable castings in mystery, the process is open to anyone, and the margin of profit is so low that people who are actually acquainted with the cost of making castings are in no hurry to rush into the business. As with all other lines of business, the one way to manufacture and realize a profit is by giving strict attention to all of its details.—P. H. Davis in Iron Trade Review.

Pipe Founding.*

BY ELIOT A. KEBLER.

In an interesting article by Mr. Jesse Garrett it is stated that cast flange pipe were used on a pump erected under the arches of London Bridge as early as 1582, and that cast iron pipe were used as water conduits in France in 1682; the way these were made has not, however, come down to us.

The first pipe were cast in this country before 1830, at Weymouth, New Jersey, for

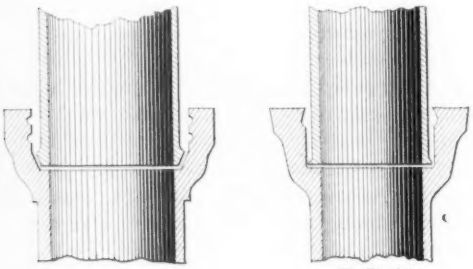
*Paper read at a meeting of the Foundrymen's Association.

the 16-inch pumping main of the Philadelphia water works.

In that early day the blast furnaces, being hardly larger than the cupolas now in use, the molds were rammed up in the casting house and were poured direct from the furnace.

Makers of these pipe claimed to know by the appearance of the "bloom," when iron suitable for pipe was tapped, and would divert such iron from the ordinary pig bed to the pipe molds as run was made. This practice could not be relied upon to give a uniform quality of iron, and the remelting method was adopted.

Early methods are sometimes revived, and some thirty years later iron direct from the blast furnace was again used, but the results were not satisfactory.



The Foundry

ENGLISH PRACTICE. AMERICAN PRACTICE.

Until about 1851 all pipe were cast horizontally, or on an angle of about 10 degrees, the mold being rammed up in green sand in a two-part flask. The core was usually made by pressing green sand on a hollow bar which was revolved on its axis, a core board being used to bring it to the proper size.

An article by Mr. Ed. Brantlet, an employe of the Brooklyn water works, was published in 1861 in the transactions of the Franklin Institute.

At the two works where Mr. Brantlet inspected, the smaller pipe was still cast on the side, and he discussed quite fully the objections to this mode of casting, either with a green sand core or with one similar to those now in use.

As late as 1873 some water pipe were still cast on the side in Pittsburg, and as a molder and helper made the molds and cores for thirteen 4-inch pipe 9 feet long, each day, a large output was certainly obtained by this method which seems so antiquated to-day.

In the English practice the pipe were cast some eight inches longer than the finished pipe, this excess being cut off in a lathe, thus removing any dirt that might have lodged in the top of the pipe, and also leaving the bead end tapering to center the pipe in when laid, there being a corresponding taper at the bottom of the socket.

In the American practice no machinery is required, a bead being cast on the spigot end of the pipe, and a wedge-shaped recess on the inside of the socket, this last keeping the joint tighter than when the half circle recess is used as in the English practice.

A visit to a modern foundry making water and gas pipe is of much interest to those engaged in the casting of metals, as the large tonnage and quick handling of the tools cannot but appeal to them.

The pit, which is usually lined with heavy stones, is circular, having a rectangular offset from one side to facilitate ramming, and having at the end a large rectangular oven for drying the molds.

The center of the pit which is built up to the level of the foundry floor, usually supports two cranes, one used principally by the casting gang, the other assisting the rammers.

The flasks are of iron, hinged vertically, and are single for large pipe, but for smaller ones, double, triple, and sometimes quadruple flasks are used.

The empty flask is placed vertically on the ramming stool, where it is rammed up by hand, a straight pattern being used for the body, the socket being formed by a separate pattern.

In some shops the mold is formed mechanically by a taper pattern or a machine which presses the sand against the sides of the flask.

The sand used is ordinarily cut over night in the foundry, but the large quantity used, as well as the limited space in the foundry, make its removal to another building desirable where it can be screened, mixed and tempered, then being returned as fast as desired by a conveyor.

Small pipe are usually molded socket up, the socket pattern slipping over the body pattern, the bead being formed in various ways, by a ring set on the ramming stool, a loam cake set into a recess in the bottom of the mold by a rubber bead ring, etc.

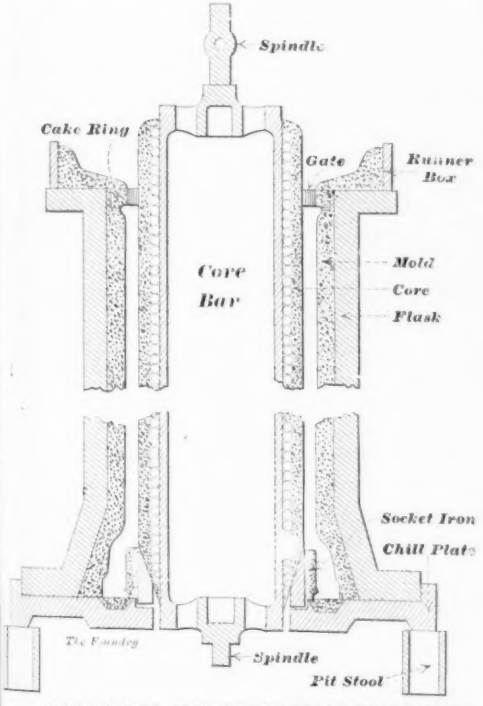
Pipe over 10 inches in diameter is usually molded socket down, care being taken that the socket cores are well made, as the iron

falling twelve feet directly on them, subjects them to such rough usage that formerly it was considered necessary to pour the pipe through a runner extending to the bottom of the mold.

After ramming, the flasks are lifted on to casting plates (usually called chill plates), which are clamped to flanges on the bottom of the flasks, and a bucket of blacking is poured through the molds to prevent cutting.

In many shops the pipe is rammed up direct on the casting plate.

The molds are now placed on top of the oven, and are dried from the inside, as they act like chimneys for the oven, the heat passing up through them.



SECTIONAL VIEW PIPE MOLDED SOCKET DOWN.

While the molds are being rammed up, a gang is busy making up the cores, starting with a steel or cast pipe, well drilled for venting as a core bar.

These bars are turned by power or hand and a rope spun by an ingenious machine from straw or marsh hay is closely wound from end to end of the bar.

A visitor, seeing nearly half a mile of hay rope being used for each pipe five feet in diameter, thinks he ought to take an hour off to show the benighted foundrymen some method to avoid this expense, not appreciating that nearly everyone connected with the industry, has been laboring for years to do away with the use of the rope. While many core compounds have been tried, and numberless collapsing bars designed to allow the bars to be withdrawn after casting, none, I believe, so perfectly meets the conditions of work here, that the use of hay has been permanently done away with in any shop in the United States.

The hay on the bar is held in place by a strong first coat of loam on which, when dried, a second coat is struck on, a core board being used to bring the core to its proper size; this board also tapers the cores at the bottom, so that they will center in the casting plate when placed in the mold.

After blacking, the cores are placed in the core ovens and dried.

In small pipe, the inside of the socket is often struck upon the body core, although a socket core made separately, to slip over a straight body core is preferred by many, as a constant depth of socket is thus assured.

For large pipe the sockets are made up separately on an iron socket ring which fits in a recess in the casting plate, the body core centering in this ring.

In the morning the dried molds are set around the casting pit, the dried cores placed in them, and dry loam cake rings with gates in them are slipped over the cores to form the top of the pipe and center the cores at the top, and a good sized runner is formed to collect any dirt.

In early days but little attention was paid to the kinds of iron used, but now great care is taken in making the mixture and running the cupolas. Some of the works employ chemists who take entire charge of the mixing and melting, they being held accountable for losses originating from these sources.

Owing to its fluidity and low shrinkage, southern iron usually makes up all or part of the mixture used for casting pipe.

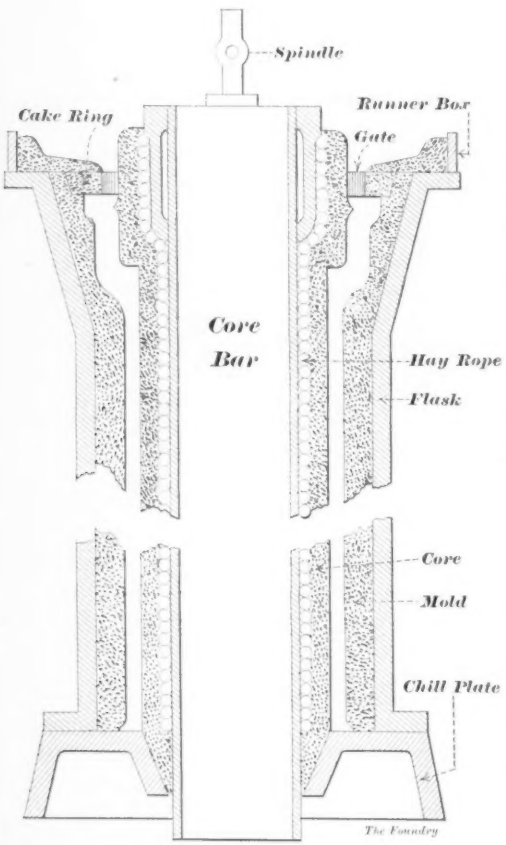
The iron melted in cupolas is tapped into ladles which, if in reach of the pit crane is picked up by it and the molds are poured. If the cupolas are further away, the ladles resting on trucks are pulled within reach of the crane by a small locomotive.

Some years ago a mule, which hauled the ladles of iron, had a way every month or two of slipping into the pit, but the foreman effectually cured him of this the next time he

fell in by hoisting him up to the roof a number of times, and while high above the floor, swinging the crane very rapidly.

After casting, the core bars are withdrawn, the flasks are hoisted from the pit, chill plates and clamps knocked off, and the pipe dropped out on a skid, the flasks being returned to the ramming pit.

The pipe now roll through the cleaning shed where the cores are cut out with steel rods, fins, etc., are chipped off.



SECTIONAL VIEW PIPE MOLDED SOCKET UP.

Pipe intended for water conduits are now heated up and immersed in a preservative liquid, usually gas house tar, which prevents rusting.

All pipes are placed in a press, gaskets placed at each end to prevent leaking, and are tested (water pipe to a hydrostatic pressure of 300 lbs. per square inch), and while under pressure are struck from end to end with a hand hammer to develop any latent defects.

The weight is now painted on the pipe, and sent to the shipping skids.

While rectangular pits with overhead travelers, circular pits with revolving linings, and other types are in use, the method of manufacture is in the main as above.

Soil pipe being cast very thin, and only about 4 feet long instead of 12 feet, are cast on the side in green sand molds and with green sand cores.

The Open-Hearth Continuous Steel Process.*

BY BENJAMIN TALBOT.

In September of last year the author was enabled to put into practical work at the Pencoyd Steel Works, Pencoyd, Pennsylvania, a process for the continuous production of open-hearth steel, the results of which have been so satisfactory, both from a practical and theoretical standpoint, that they cannot, in the author's opinion, fail to interest manufacturers generally.

To-day two processes for the manufacture of steel stand pre-eminently before the world—the Bessemer and the open-hearth process. Both present certain advantages, and also certain disadvantages. The rapidity of the Bessemer is obtained only by a very large initial outlay, and by heavy waste of metal. The open-hearth, on the other hand, whilst giving a far higher yield per unit of metal employed, demands a much longer time, and, consequently, heavy labor charges. As usually carried out, the general practice in open-hearth working is to charge solid pig iron and scrap into the furnace, and although attempts have been made to charge the furnace with molten metal it has been found that no great advantage attends this method of working, since no refining is accomplished whilst melting down, as is the case when solid material is charged into the furnace. The rapid destruction of the furnace bottom has also been found in practice to militate against charging molten metal directly on to the hearth. Again, when solid material is charged into the open hearth, hours of valuable time are consumed before the furnace contains the necessary heat to enable the ordinary slag additions to be made in order to purify the charge and convert the metal into steel of the desired quality.

*Abstract of paper read before the Iron and Steel Institute.

In ordinary practice, when the bath of steel is finished, the furnace is tapped and completely emptied, cooled off, and repaired, and has to be heated up again before a fresh charge can be introduced to undergo the same cycle. It is this point of intermittent refining, and the necessity of emptying the furnace and operating over a wide range of temperature, that appears to be the one upon which great improvements are possible in the output of the metal obtained in open-hearth practice.

Thus in the Bessemer, what is gained in time and labor is lost in yield; and the gain in yield in open-hearth practice is largely annulled by loss in time and cost of labor. Like all steel manufacturers, the author has given much time and attention to these questions, to see if it were not possible to manufacture steel by some process which, while giving the continuous production of the Bessemer, should also give the yield of the open-hearth. The process now at work at Pencoyd represents the results of his labors. To in any way approach the rapidity of Bessemer practice on the one hand, and the yield of the open-hearth on the other, the following conditions seem to be essential to success:

(1) The use of fluid metal from blast furnace, mixer, or cupola, to avoid loss of time and oxidation by air during melting in the Siemens furnace, and to ultilize the heat of the molten metal.

(2) The oxidation of the metalloids should be effected entirely by means of solid oxides of iron, and not by the action of the air.

(3) Maintaining by some suitable means a large reserve of heat to keep the oxidizing slags and metal in a fluid condition, and to insure the rapid removal of the metalloids from the molten pig iron.

In carrying out experiments on the refining of metal to remove the silicon and part of the phosphorus from very silicous iron, the author was particularly struck by the large amount of heat developed by the oxidation of the silicon, and the comparative immunity of the hearth from wear and tear, provided that the slag was never allowed to come in contact with the hearth, the latter being protected by a bath of metal; in other words, provided the bath was never emptied of metal. So impressed was he with these results that he determined to try if he could not carry the process further, and so modify it as to produce finished steel continuously. As if this could be shown to be feasible he saw that he would be able to carry into practice the three conditions necessary for economic production which have just been enumerated. In discussing this idea with many practical open-hearth operators and managers, the universal opinion was that the hearth would be speedily wrecked. However, whilst these opinions were discouraging, it was thought that they were based upon conditions which would not be encountered in the author's continuous method, as the following considerations will make clear.

The great trouble with hearth and bottoms of furnaces which at times arises in ordinary practice, both acid and basic, is brought about primarily by the action of the slag, and not by the metal. If, after considerable work, the face of a basic hearth is examined, it will be found to be nearly of the same composition as the slag produced in the furnace. In course of time the impurities in the hearth so increase that it becomes less refractory, and cannot withstand the heat of the finished steel when hot enough to cast, and consequently holes are formed, and especially is this the case if molten metal be poured directly upon this softened hearth. To overcome this drawback the slag must be prevented from washing and impregnating the lower portion of the hearth every time the furnace is tapped. This can only be accomplished by flowing the slag off from the surface of the bath through a slag-spout at the foreplate level. Such a method of working naturally suggests a tilting furnace, from which any percentage of metal or slag can be poured out when desired. The furnace should also tilt in both directions, so that slag can be poured off from the opposite side to the metal.

Influenced by these considerations, the writer devised the present method of working at Pencoyd, which is carried out as follows: The furnace in use is a basic-lined tilting-furnace of 75 tons capacity. The pig iron to be converted has an approximate composition of:

Carbon.	Silicon.	Sulphur.	Phos.	Mang.
3.76	1.00	0.06	0.90	0.40

Owing to the absence of blast furnaces, this pig iron has to be melted in cupolas. The furnace should be charged on Sunday evening with about 50 per cent molten cupola metal and 50 per cent of scrap, and this first

(or filling) heat is worked down to steel in the usual way. When the bath is good finished steel, about one-third of it is poured off into a ladle and cast into ingots. No slag is run off with the steel. After tapping off this one-third of the charge, oxide of iron in a fairly fine state of division is added to the slag, and as soon as this is melted about 20 tons of molten cupola metal are run in to replace the steel tapped out. An immediate very active reaction takes place, during the continuance of which the gas is cut off from the furnace. The reaction has all the characteristics of the Bessemer blow during the elimination of carbon, a large volume of CO being given off, which immediately ignites and burns with an intense flame, the heat thus produced partly raising the temperature of the bath and partly being absorbed by the regenerators. After the metal has boiled vigorously for some 10 or 15 minutes, the slag, which is now almost deprived of iron oxide, is partly poured off, and the bath worked down into finished steel by the help of fresh additions of iron ore and lime. When the bath is ready one-third (or about 20 tons) of steel is cast, fresh slag additions are made, and another 20 tons of molten cupola metal run in as before. These operations are continued during the whole of the week, the furnace being completely emptied only on the Saturday. The taphole is some few inches below the fore-plate level, so that no slag is taken in the steel ladle. This is arranged by stopping the hole sufficiently to prevent metal or slag working into it. When the furnace is ready to tap, it is tilted slightly, so that metal is above the tapping-hole, a bar is plunged through, and the metal always runs first. As soon as the desired quantity is obtained, it is tilted back over towards the charging side. This causes the level of the bath to fall well beneath the inside of the taphole, which makes is possible for the furnace-helper to dry and clean it rapidly, and plug it up without delay.

Whilst this is being done, the slag line is examined, gas is turned on, and whatever repairs are necessary are made by throwing raw dolomite, or limestone, mixed with 5 per cent pitch or rosin, on the banks at a space from 6 in. to 9 in. above the level of the reduced bath. The surface of the bath is very useful, as it prevents the repairing material, in a great measure, from rolling down. It acts as a floor or foundation, and tends to hold the dolomite in place. Whatever does roll down becomes incorporated in the slag, and is beneficial.

In any empty furnace much basic material rolls down into the bottom, where it is not required, and in many cases tends to fill up the hearth.

About 3 hours 40 minutes is the period of time between two successive casts of steel at Pencoyd, and about 27 or 28 casts are usually made per week, including the filling and emptying heats. This number of charges, however, is obtained when starting with fluid metal on Monday night, as, having only one cupola, which has to be repaired each week-end, it cannot be got ready before Monday evening. Starting on Sunday night, either with cupola or blast-furnace metal, and working at the same rate as during the other part of the week, from 32 charges to 34 charges would readily be obtained, increasing the output at least another 100 tons per week. It is not possible to give the actual consumption of fuel, as the furnace is worked from the main gas tube, which supplies several other furnaces. It is interesting to note that from 25 per cent to 33 per cent less deoxidizers are required for the steel from this continuous furnace than for the other furnaces to give the same percentage of manganese (from .40 per cent to .50 per cent) in the finished steel.

Many hundreds of heats and thousands of tons of steel have been made by this method with very satisfactory results, all grades of metal having been produced, from dead soft up to .40 carbon steel. The question of excessive wear to the hearth, about which many doubts were entertained, and upon which the practicability of the method depended, has never given the slightest trouble, the hearth being practically in as good a condition as when put in eight months ago. This proves that a heavy surface reaction of short duration is confined to the bath, and does not affect the bottom of the hearth. As might be expected, the smaller the percentage of liquid cast iron added, the quicker this addition is purified. The data obtained proves this conclusively, as the higher the temperature the quicker the purification. It also indicates that furnaces of 100 tons to 120 tons capacity are quite practicable, and would be easily handled. In fact, with high-power gas, which does not require regeneration, this size will probably be surpassed.

It will thus be seen that the three conditions which the author considered necessary have been fulfilled. Liquid metal has been used without destroying the hearth, oxidation effected entirely by oxides of iron with concentration of the heat due to chemical action in the bath of metal, and also the heat developed by the combustion of the carbonic oxide evolved; and these conditions, and the storage of a large reserve of heat to sufficiently assure the fluidity of both metal and slag, and promote rapid chemical action, are obtained by the simple expedient of maintaining a large bath of molten metal in the furnace ever ready to receive fresh additions of molten furnace metal and oxidizing reagents.

The retaining of this bath or pool of metal in the furnace is the vital and central feature of the process, and is the one upon which its success chiefly depends. It enables any grade of metal to be successfully used, the percentage of such metal added at any one time being varied according to its composition, and it also enables any quantity of steel to be drawn off to suit the requirements of the mills at the particular time. The high temperature of this large bath rapidly raises the temperature of smaller liquid additions, melts the oxidizing and basic materials added, and thus facilitates rapid chemical action, by which more heat is produced. It may be regarded as bearing the same relation to the process as the fly-wheel does to an engine, or the accumulators to the hydraulic press, acting as a storehouse of energy, ever ready to give it out when required.

In the ordinary open-hearth furnace, during the melting period, two-thirds of the carbon and practically the whole of the silicon and manganese are oxidized by the air during melting, and thus they are not available as reducing agents in the bath, whereas in the process under consideration the whole of these are available to reduce their equivalents of iron, and also the heat produced from their oxidation is practically concentrated in a very short space of time, with an increase in temperature of the bath similar to that produced by their combustion in the Bessemer converter. When it is remembered that, taking a metal with 3.5 carbon, 2.0 silicon, and 1.00 phosphorus, every 20 tons contains 14 cwts. of carbon, 8 cwts. of silicon, and 4 cwts. of phosphorus, it will be seen that both the reducing and heat-giving power of these constituents is not a mere piece of theory, but a practical fact.

As regards the practical management of the furnace, and the question of repairs generally, a few words may now be added. During recent years, the tendency in open-hearth practice has been constantly to increase the size and capacity of the furnaces, with the result that larger ladles, cranes, etc., have to be employed to deal with the increased weight of the cast. Owing, also, to the length of time between each cast, the mills are not kept regularly supplied with ingots, being often unduly pressed immediately after tapping, and having to wait before the next cast can be tapped. One of the advantages of the process as carried out at Pencoyd is the regularity with which the mills can be supplied with ingots, and the weight of the metal cast regulated in accordance with the requirements of the rolling department.

With reference to the important question of scrap in connection with this method of working, solid scrap has been charged into the steel bath many times to observe whether any saving of time could be effected by diluting the carbon and phosphorous; but its chilling effect was so pronounced that the heats could not be made as rapidly as when the impurities were eliminated by the usual oxide of iron additions. In fact, it were possible to introduce the basic additions in a liquid condition rather than solid, the temperature of the bath would be appreciably benefited. It is probable that the present practice of charging furnaces with cold scrap, and melting this down in an oxidizing flame, which results in a large waste of iron, is wrong. The question has been put, what is proposed to do with scrap when using the continuous method? The answer is, if it cannot be disposed of profitably, put all that is suitable through the blast-furnace. This is the most efficient melter we have, both as regards fuel and waste. The scrap will also be carbonized and will become cast-iron. In the large bath of pure metal stored, we have a more than efficient substitute for cold scrap, as it is standardized in quality, and is in liquid condition.

If, therefore, we can melt scrap, impregnate it with carbon for less fuel, and with less waste, than is now taken in melting and oxidizing it in the open-hearth practice,

it should be more economical to put it through the blast-furnace. By eliminating the carbon from this metal again, more oxide of iron can be reduced, and a better yield obtained, than if it were simply charged direct into the steel furnace in its decarbonized condition. The period of time will also be saved to the steel department, which is now lost in charging scrap in detail, and waiting for its melting. This represents a serious loss in labor alone, as the leading men employed upon the furnace are skilled melters, earning large wages for refining metal. They may as well be kept busy at this purification, rather than wait for hours before obtaining a satisfactory refining temperature.

Possibly many steel works managers may rather object to what may seem equivalent to writing the scrap down to pig iron price, but after all this is only a question of figures, and the actual value of the metal is not affected, whether it is melted in a blast furnace, cupola or open hearth, except in so far as one is a cheaper melter than the other. In cases, however, where it may not be advisable or convenient to melt in a blast furnace, one or two ordinary fixed Siemens furnaces, working 75 per cent to 80 per cent scrap, by which means four to five heats can be obtained from each furnace in 24 hours, will readily deal with all the scrap produced. In all Siemens works, with exception of large plate mills, the difficulty is not so much to deal with scrap as to obtain sufficient quantity at a reasonable price, to enable 20 per cent to 25 per cent to be used in the open hearth. No doubt this is especially felt at present prices.

In some cases it may be found convenient to establish a storage of liquid metal between the blast furnaces and the steel furnaces. In this event the usual mixer used in Bessemer practice will be very suitable. If the metal stored should be very silicious, it might be better to perform a certain amount of purification whilst being held. This vessel could then be a furnace, basic lined, so that an oxidizing slag could be carried, which would have a refining influence upon the liquid metal added from time to time.

This preparatory furnace would quicken the operation in the finishing furnace, for if the silicon were practically eliminated, and the carbon somewhat reduced, the metal would be purer and hotter, and so would expedite complete purification. It is not anticipated, however, that this will be necessary except in special cases, as one of the advantages of the process is the ease with which it lends itself to the production of steel from blast furnace metal of irregular composition, owing to the large extent to which the impurities are reduced by dilution as apart from oxidation. Thus, assuming that 20 tons of molten pig iron containing 3.0 per cent of silicon were teemed into the bath of 40 tons of molten finished steel, the silicon by mere admixture would be reduced in the resulting metal to 1 per cent, which is not an abnormal percentage for basic Siemens work, and, as this would be almost immediately oxidized, the somewhat silicious slag could be flowed off before it would have time to seriously attack the banks of the furnace, even if sufficiently acid to do so. This continuous method should certainly be worthy of the consideration of acid open-hearth steel manufacturers, even if they discarded the acid lining, and took up the basic, which lends itself so satisfactorily to the process. Acid bottoms gave way to the basic in puddling, and there is apparently no reason why history should not repeat itself in the case of steel.

In this age, when on the one hand the difficulty of obtaining hematite ores which will produce a pig with less than .05 per cent of phosphorus is becoming greater and greater, and on the other hand engineers are more stringent than ever in insisting upon low phosphorus material, the adoption of this process with a basic lining would enable all those ores just outside hematite limit to be used, and the steel-maker might with absolute certainty depend upon a finished steel produced with under 0.03 per cent phosphorus; when using hematites, iron of present grade, say under .06 per cent of phosphorus, still lower results would be possible.

The highest desideratum of any lining is to be passive, whilst the metal it holds is under treatment, and when this result is obtained with a basic hearth, it should be used even if the pig metal is sufficiently pure not to require dephosphorizing, providing the steel is made at a less cost.

The accompanying Table I. shows the weight of materials charged and yields obtained. In obtaining 106 tons of steel for every 100 tons of metals charged we realize a very satisfactory result. This gain in yield

has a beneficial effect in the cost sheet, and leaves a handsome margin after paying for the oxide of iron which is used to bring this about. It is a great contrast to the Bessemer, which wastes 13 per cent or more of the pig metal to do the same work. This yield has been obtained with a low silicon metal, and will be increased with more impure metals, so that with this method we obtain exactly opposite results than with the Bessemer, for in the latter the more impure the metal the greater the loss.

TABLE I.

Summary of Six Weeks' Working, Starting with Fluid Metal on Monday Night.

Average No. of heats per wk.	Average No. of hours in the furnace.*	Average weight of metals charged per week.	Average weight of ingot and scrap produced per week.	Average yield of ingot and scrap per 100 parts of metal charged.
		Long Tons.	Long Tons.	
27	3.8	488	517	105.94

*Exclusive of filling and emptying heats.

The author considers that the method of working described in this paper offers advantages over the ordinary practice in many particulars. Amongst the chief of these may be cited:

1. The cost and delay in charging cold material is avoided.
2. A saving in fuel in charging molten pig iron, and also through not cooling the surface by charging cold material.
3. The demand for a large and regular supply of good scrap, so important in ordinary practice, is wholly dispensed with.
4. A regular supply of steel to the mills in any wished-for quantity and at frequent intervals is insured.
5. An increase of output.
6. An increase of yield.
7. Less repairs to furnace.
8. Saving in labor charges, due to far less skilled labor being required per given quantity of steel.
9. The possibility of using very large furnaces, with consequent reduction in cost of production, without the necessity for very large cranes and ladles.

High tuyeres in a cupola are an inheritance left us by our forefathers in the foundry business, of which we have never got rid.—Kirk.

Among the Foundries.

C. W. Caldwell is building a foundry at Portage, Ohio.

A. H. Clark has established a foundry at Wayland, Mich.

Gibson & Co. will erect a foundry at Ballard, Wash.

James Bartell intends to erect a foundry at Mound City, Ill.

Krauss & Haas have started a foundry at East Greenville, Pa.

The Chattanooga (Tenn). Stove Co. will build a new foundry.

Glick & Cooper, of Terre Haute, Ind., have erected a new foundry.

The New Athens (Ill.) Foundry Co. has certified to a dissolution.

Wehrenberg & Bartleson will erect a small foundry at Cairo, Ill.

William Vietor, of Lansing, Mich., is building a new brass foundry.

The Choctaw, Oklahoma & Gulf R. R. has built a foundry at Shawnee, O. T.

The Mansfield (Ohio) Machine Works is putting up an addition to its plant.

S. W. Evans & Son will erect a new brass foundry at Frankford, Philadelphia, Pa.

H. W. Butterworth & Sons Co., of Philadelphia, Pa., are building a new brass foundry.

The La Crosse (Wis) Plow Co. has had plans prepared for a foundry 50x124 feet.

The Pennsylvania Steel Co. are rushing work upon their new foundry at Steelton, Pa.

The new foundry of Francis Longstaff & Son, at Mechanicville, N. Y., is nearly completed.

The Cureton Foundry Co., of Mt. Vernon, Ohio, intend to erect a larger foundry at an early date.

L. Wintgert, of Montpelier, Ohio, has purchased the Auburn, Ohio, foundry and machine shops.

The Cape Breton Foundry & Mach. Co., at Sydney, Nova Scotia, has been purchased by James Clark.

The American Foundry & Machine Co., of Hanover, Pa., are building an extension to their foundry.

The Summit Foundry Co., of Geneva, N.

Y., has increased its capital stock from $50,000 to $75,000.

A newspaper report states that Davis & Campbell, of Coshocton, Ohio, will build a foundry at that place.

P. H. MaGirl, of Bloomington, Ill., proposes to erect a new foundry as soon as a suitable site is available.

Andrew N. Peterson has purchased the old established plant known as the Eagle Iron Works, at Brooklyn, N. Y.

The Winder Foundry & Machine Co. has been organized at Winder, Ga., by R. L. Carithers and J. M. Hood.

Henry Durney has retired from the partnership known as The Dartmouth Iron Foundry Co., Dartmouth, N. S.

S. J. Benedict is about to remove his foundry and machine shop from East Randolph to Salamanca, N. Y.

The Monarch Mfg. Co. of Des Moines, Ia., is reported as intending to erect a foundry in the immediate future.

The Hennessy Foundry Co., of Springfield, Ohio, are rebuilding their foundry, destroyed by fire some time ago.

Hunt, Helm, Ferris & Co., of Harvard, Ill., manufacturers of haying tools and hardware specialties, will erect a foundry 40'x100'.

The Hartford Foundry Co., of Hartford, Conn., has been organized by John W. Conway, Ernest H. Cady and Ernest Cady.

It is rumored that the Barney & Smith Car Co., of Dayton, Ohio, will soon be absorbed by the American Car & Foundry Co

Frank Martin and Edward Garties, proprietors of the Harrison, Ohio, foundry, have dissolved partnership, Mr. Garties retiring.

The Berks Foundry and Machine Works at Reading, Pa., which was partly destroyed by fire several months ago, has resumed operations.

The Western Electric Co., of Chicago, have purchased larger quarters on Polk street, on which new shops, including a foundry, will be erected.

The Enterprise Foundry Company, of Knoxville, Tenn., has leased the foundry located at Bristol, Tenn., and will operate the latter to its full capacity.

Mr. Green has retired from the firm of Green, Early & Burns, of Hastings, Mich., and the business will hereafter be carried on by the two last named gentlemen.

A charter has been issued to the National Foundry & Supply Co., of Greensburg, Pa. The incorporators are: E. H. Dermitt, A. H. Lang, W. S. McKee, George B. Lang and Herbert Overly.

Smith & Co., operating the Columbian Foundry at Brooklyn, N. Y., have purchased the Healy Iron Works, of the same city, and will use the latter for architectural work, reserving the Columbian shop for machinery and jobbing castings.

J. K. Kuhn, of Chattanooga, Tenn., who some time ago disposed of his plant to the Chattanooga Steel Roofing Co., will, it is reported, repurchase the same, as soon as the latter company remove to their new plant, which is nearing completion.

Charles G. Menzel and J. A. Jeffery, formerly president and treasurer of the Menzel Foundry Company, of Minneapolis, Minn., have purchased the entire stock of the company and will continue the business under the firm name of Menzel & Jeffery.

C. F. Groenke, proprietor of the Merrill, Wis., Iron Works, has disposed of his property to a stock company, to be known as the Merrill Iron Works, capitalized at $25,000, and officered as follows: John Daly, president; John O'Day, vice-president; William Gebhart, secretary, and Elmer Burr, treasurer. The plant will be under the personal supervision of Mr. Burr.

J. W. Morrison, Jr., proprietor of the Morrison Foundry & Machine Wks. and Youngstown Brass Works, Youngstown, O., has bought the crane, ladles, flasks and other equipment of the Sharpsville, Pa., foundry and is removing them to his plant, where he is making extensive improvements. The work will be completed early in September. Benjamin Evans is in charge of the foundry department.

The Westinghouse Machine Company, of East Pittsburgh, have purchased the old plant formerly operated by the Robinson-Rea Mfg. Company, on the South Side, Pittsburgh, and are operating it as a foundry. The capacity of the present plant of the Westinghouse Machine Company at East Pittsburgh is entirely inadequate to

supply the demand for their engines, although at the present time they have nearly completed an addition to their foundry at that point, which will virtually double its capacity.

A new corporation, styled the American Foundry Company, will build a foundry at Rockford, Ill., which is to be larger than any other now in that city. Geo. D. Roper is president. S. S. Brumbaugh secretary, treasurer and general manager, and C. H. Hopke vice-president and superintendent. The capital stock is placed at $30,000. The company will make the best grade light gray iron castings and will have a large amount of business from the outset. The Eclipse Gas Stove Company of Rockford have a contract with the new firm to make all the iron castings used in the manufacture of their stoves, and this alone will be a large item of business. The buildings will be located on the south side of Tinker street and will extend from a point 200 feet west of Main street to the viaduct. The main building will be erected at the west end of the tract and will be 275 feet long by 75 feet wide, following the bend of the street toward Winnebago street. A cleaning room 50 feet square will be built at the east end and south of the main building, and the cupola and other appurtenances of the foundry will be located on the south side. The buildings will be of brick, with truss roofs, doing away with columns and interior supports and leaving the floor clear for the workmen. The floor in the main foundry will have only one aisle.

The Benedict & Burnham Manufacturing Company, of Waterbury, Conn., have been absorbed by the American Brass Company, who were formed in December last with a capital of $6,000,000. The latter company have headquarters in Waterbury, Conn., and it will be recalled were formed by the amalgamation of the Coe Brass Manufacturing Company of Torrington and Ansonia, Conn., the Waterbury Brass Company of Waterbury, Conn., the Ansonia Brass & Copper Company of Ansonia, Conn. At a meeting of the stockholders of the American Brass Company it was voted that the Benedict & Burnham Manufacturing Company be purchased, and that the capitalization of the former company be raised to $10,000,000 by the addition of $2,000,000 for the Benedict & Burnham purchase, and $2,000,000 more to remain in the treasury at the disposal of the directors for future purchases. By the terms of the purchase, each stockholder of the Benedict & Burnham Company receives for each share of his stock one-quarter shares of the American Brass Company's stock, or, in other words, $125 par value of American Brass stock in exchange for $25 of Benedict & Burnham stock. The absorption of the Benedict & Burnham brings into the American Brass Company another of the most formidable concerns of the Naugatuck Valley.

Deaths.

John Milton Gaar, president of Gaar, Scott & Co., Richmond, Ind., died in that city recently aged 77.

Peter B. Lamoreaux, who a few years ago established the North Star Foundry at Owatonna, -Minn., died recently at Fari bault, Minn., aged 49.

John W. Watkins, for several years foreman of the Baxter Stove Co.'s foundry at Mansfield, Ohio, died suddenly while on a visit to Albany, N. Y.

Lewis Kalt, proprietor of the Maple City Brass Foundry at Norwalk, Ohio, while at work in his foundry was overcome by the intense heat, fell forward in a pile of sand and expired instantly.

Thomas Kingsford, head of the Kingsford Foundry & Machine Works, and a leading manufacturer of Oswego, N. Y., died in that city on September 7, aged 73 years. He was born in England, but came to this country at an early age.

Fires.

The foundry of Fort & Jaques at Nashville, Tenn., burned Aug. 30.

The Eureka Foundry at Eureka, Calif., was completely destroyed Sept. 3.

The South Bend (Ind), Foundry Co. suffered severely from a fire Sept. 7.

The Bellwood Mfg. Co., of Bellwood, Pa., had their plant entirely destroyed Sept. 6.

The Arnott Mfg. Co., of New Hampton, Iowa, had their foundry badly scorched Aug. 30.

The Raymond & Campbell Mfg. Co., of Middletown, Pa., had its foundry badly damaged by a recent blaze.

The Detroit (Mich.) Steel & Spring Co. had their foundry gutted by water and otherwise damaged in a recent fire.

The Stearns Molding Machine.

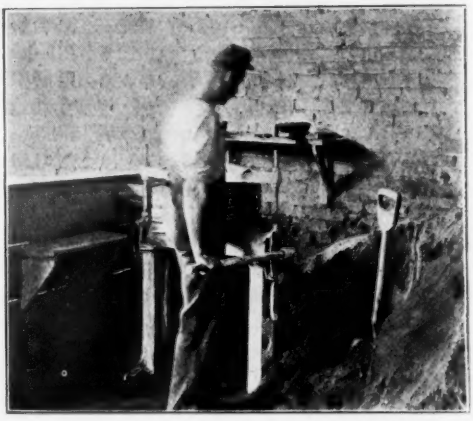
That operators of foundries are fully alive to the possibilities existing to reduce the cost of their output through the use of mechanical appliances is shown in the great number of new molding machines appearing on the market.

One of the latest of these, shown in the attached illustrations, is manufactured by E. C. Stearns & Co., Syracuse, N. Y., who manufacture hardware and turn out small and medium size castings in large quantities. They say that after trying several

types of molding machines they have found none which were absolutely suitable for their class of work, and they consequently built one for their own use which they are now placing on the market in a general way.

In addition to pointing out the gain which is effected by the molding machine, E. C. Stearns & Co. also say that all work intended to be assembled without grinding, or in other words to be cast fit, comes out

more perfect and with scarcely any loss where the work is done with a machine.



Instead of using sprue cutters the manufacturers suggest the use of a sprue with a

hole in it to set over the draw pin in the pattern, a hole being cut in the presser board sufficiently large to admit the head of the sprue. When care is taken that the sprue is not long enough to strike the presser head of the machine the result is a much cleaner pouring gate than is obtained with a sprue cutter.

As our illustrations show the machine in a set of complete operations, but little description is necessary. Any one desiring further information about this machine may obtain same by addressing the manufacturers.

An Old Western Foundry.

On the north side of Huron street, about a square from Canal street, stands one of the oldest buildings and the oldest manufacturing building in Grand Rapids. The venerable old structure was built in 1842 by John Ball. It was used then, as it is today, for a molding shop. The material used in its construction was limestone. Labor and limestone must have been cheap in the pioneer times, for the building's walls are 22 inches thick. This unusual thickness, combined with the excellent care which the builders used, has made the old shop resist time and weather in a remarkable manner. Since its construction the masonry has outlived two new roofs. The third roof has been built four years. An addition of brick was made several years ago for use as an engine room. This building is in far worse repair than its older neighbor. On the south end another addition has been made which has not stood the test of time like the old foundry. The old structure is 50 by 80 feet and from foundations to gable is 25 feet. The simple inverted V roof and the two sides sloped to within about 15 feet of the ground.

Inside the walls are nearly black with the dust of 58 years. At the south end are two iron cupolas which have been in use 30 years. The massiveness of the shop has undoubtedly been responsible for its present solidity. It will soon be demolished and replaced by a more commodious structure. Its destruction will not be caused by infirmity but simply because it is not large enough nor convenient enough for its owners, the Butterworth & Lowe Company. It is part of their large mill machine manufactory and would be used ten years more were it not for its lack of modern necessary conveniences.

In 1852 R. E. E. Butterworth bought a half interest and the firm became Ball & Butterworth. A few years later the latter became sole owner. In 1869 James Lowe acquired a half interest, and the factory was continued for a long time as a firm and later as a corporation, until the present time under the name of Butterworth & Lowe.—Grand Rapids (Mich.) Herald.

What the Inventors are Doing.

(Contributed by A. E. Fay, "The Lincoln," 10th and H sts., Washington, D. C., who will upon application furnish information concerning all patents, especially those referring to the metal trades.)

M. H. Fletcher, of Cincinnati, Ohio, has made further improvements in his machine for coating core bars, which was illustrated in our issue of August, 1897. The last patent is No. 645,948 and was granted March 27, 1900. As will be recollected, Mr. Fletcher's process is principally applicable to cores intended for water and gas pipe. A special mixture composed of starch and sawdust is applied to the core bar in place of the usual hay-rope and accomplishes the object of the latter.

Eli Millett of Springfield, Mass, the inventor of the well known Millett Core Oven, has been granted patent No. 649,135, issued May 8, 1900, for further improvements in his core oven, which, through the use of removable shelves, gives the oven greater capacity when small cores are being baked. In order to increase the fuel economy of the oven the hot air is made to pass through the core shelves twice through special arrangement of the draft pipe.

The Coke Trade.

The coke trade is a paradox just at present. While the production and shipments shows a stationary attitude or a decrease from week to week, yet the undercurrent of the market shows that the low level has been reached, and that the production and output may be expected to move upward in the near future. The railroads report a better outlook, and barring the temporary blowing out of a few furnaces which affect the consumption of Connelsville coke, the iron

and steel markets also show strength which is gathering day by day.

At this time of the year the old bugaboo about car shortage bobs up in the chief markets. Reports of this kind are already rife in Chicago and other western centers, naturally in the West first because the car shortage is first felt in that part of the country, the great crops of the middle plains taking a large percentage of the box cars for the transportation of grain to the elevators and the domestic markets all over the United States. But there is no distinct evidence that the car supply will be so short this fall as it was a year ago. The output of coal and coke will be little if any larger than usual, and the number of cars will be greater. The crops will probably not be as heavy as they were a year ago. It is not probable, therefore, that there will be any serious trouble from this source during the fall months. In Chicago and other western markets the coke situation is quiet. Consumers seem to be well stocked and it is reported that efforts to force the fuel only bring about further concessions.—Connellsville Courier.

Two Consolidations.

Some time ago it was reported that the dividend rate of the United States Cast Iron Pipe & Foundry Company on its preferred stock would be reduced from a 7 per cent to a 4 per cent basis. It was stated yesterday, however, on what is apparently good authority, that the directors will pass the September dividend altogether. Furthermore, it is reported that a radical reduction in the capitalization is contemplated and that a committee will shortly be appointed to carry out this policy. The company has for some time been classed with industrials whose operations can hardly be said to have shown satisfactory results. The common stock is now quoted around 4 and the preferred around 34. The company has an authorized capital of $30,000,000, equally divided between 7 per cent preferred stock and common stock. Of this about $12,100,000 of each issue is outstanding. The company has paid three quarterly dividends of 1¾ per cent each on the preferred stock. At the annual meeting held early in the summer no financial statement was made public, but it is well known that the earnings of the company have been disappointing. In the summer of 1899 the earnings averaged around $115,000 a month, but in December, 1899, they were only about $36,000, the company's business falling off severely in the winter season. The company suffered from the high prices of iron ruling last year and also from severe competition. It did not have control of the market for its product and its rivals have been active.

The prices of the securities of the Central Foundry Company, which is also a consolidation of iron pipe makers, though concerned with only what is known as the soil pipe industry, would also indicate that that company had had a disappointing year. The preferred stock is now selling at 10 and the bonds are quoted at around 85. The common stock scarcely has a market. The company is capitalized at $14,000,000, comprising $7,000,000 of 7 per cent cumulative preferred stock and $7,000,000 of common stock. In addition there are $4,000,000 of 6 per cent bonds, about half of which are held abroad. It was learned yesterday that the company's net earnings for the eleven months ended June 30 were $673,000, and the surplus after interest charges $404,000. The company's by-laws provide that there shall be purchased for the sinking fund each year an amount of bonds equal to 33 1-3 per cent of the net earnings after interest charges have been met. In accordance with this $137,000 of bonds were retired by the sinking fund, but as the bonds are below par the expenses in this operation was about $120,000, leaving about $284,000 surplus.

It is said that the company suffered from an accumulation of raw material at high prices, but that it is now working off these stocks. The sales recently are reported to show material increases.

A banker familiar with the company's affairs, when questioned yesterday, said: "At $10 per share the market value of the entire issue of preferred stock would be only $700,000, whereas the company shows earnings after interest charges of over $400,000, and of $284,000 after this and the provision for the sinking fund. This latter sum is equivalent to 40 per cent on the present market price of the preferred stock, and to 4 per cent upon its par value."—Journal of Commerce.

A good foreman, like a good molder, pays his own way.

Rather Flowery.

Mr. R. A. Porter has just moved into his new foundry, the Saidie Clare, which bears the pretty name of his still prettier little daughter. In a quiet way there is no more useful or busy place in town. Mr. Porter is an expert molder and foundryman having spent his life at the business. In his new building he has every convenience for making his castings quick, strong and cheap having superintended its entire construction himself. In plain iron castings his work is exceptionally clean and clear cut while in bronze and brass his long experience is proclaimed in the grace of outline and delicacy of color that distinguishes every piece. Talladega has reason to be proud of the Saidie Clare, for whether its product be a casting for a ponderous engine or the dainty key of milady's boudoir it is a work of strength and beauty.—Talladega, (Ala.) Reporter.

An Old Institution to Close.

A dispatch from Paterson, N. J., says that the Rogers Locomotive Works, which has built locomotives for every country in the world, will busy itself during the next three months in finishing up what work is on hand, and on or about Dec. 1 its doors will be permanently closed as a locomotive works and also probably as an iron works of any kind.

The start of the great works which up to this time has been the largest single business in Paterson was made in 1800, when John Clark, of Paisley, Scotland, started an iron works on a part of the present site. Thus not only the largest, but the oldest, industry of the city is to end. Thomas Rogers was a carpenter and entered the employ of Clark. In 1810 Mr. Rogers became a member of a firm organized in that year, and the Rogers family has since been the principal owners, although the works have borne many names during the last 90 years. Robert S. Hughes, the president of the company, died three weeks ago. The principal owner is Jacob Rogers, but he is old and has taken no active part in the business for ten years. The works, although still paying, are so old that they are hampered by lack of modern machinery and improvements, and to bring them up to date would require more money than Mr. Rogers cares to invest.

Besides this, the works are situated away from the railroad lines, and the locomotives have to be hauled through the streets by horses. The works were never busier than they are now. As fast as work on hand is completed hands will be laid off until all are gone. George H. Longbottom, vice-president of the company, will have charge of the winding up of its affairs. The first locomotive was built at the works in 1852. At that time and for twenty years afterward the main industry at the works was the building of cotton mill machinery.

No Place Like Home.

A few weeks ago a large number of American rolling-mill hands were brought here from Terre Haute, Ind., and other places in that section to work in the large iron foundry and steel plant here. The men were so displeased with the situation in Mexico that most of them have resigned their positions and returned home.—Durango (Mexico) Correspondence.

A Good Rig is Everything.

While traveling west some time ago I went into a shop that was making Bennett & Peck's heater work, and I saw what I thought was a very good rigging for making the domes for heaters, but I saw then what can be seen in almost any foundry, poor tools. If there was a load of a ton on the crane they were all afraid to work under it. The foreman said he had a hard job to get his employers to put a better one in. They even kicked because he made an iron flask for molding the dome in; but in the end they admitted that it paid. I present to you a few sketches I made from memory of what I saw there. The casting was made in a flask about 4′ 0″ wide and about 5′ 0″ long (these figures are only approximations), the drag and middle part were about 16″ deep and the cope 8″, there was also a bottom plate. If you will look at Figs. 3 and 8 you will get a fair idea of the shape of the casting to be molded. You will see in Fig. 3 that the pattern is parted in three pieces, the first part being placed on a flat board as shown in Fig. 1. On this board is a raised piece so that when the bottom piece of the pattern is set

on the board it is even in the center—it is an ordinary follow board, in fact—and on this center piece a ring is placed as shown in Figs. 1 and 2. On one side of this ring are cast three points or guides, on the other side are cast five sets of dovetail pieces whose position corresponds with the five openings in the casting. These dovetail pieces fit accurately in the follow board so that the sand or ramming will not disturb the position of the ring. After ramming up to the top of this lower piece of the pattern, you place this ring on the board as shown in Fig. 2, and on each of the guide pins you place a piece shaped like Fig. 7. The legs of these pieces will reach the sides of the box as shown. If they do not quite reach you can wedge them, but they must be fast, for on them depends your guide for setting the core back again. The pins or guides on the ring are also handy for setting the core down on, if others wish to use the crane. After the ring has been placed you finish ramming, bedding your bottom plate on perfectly solid, being sure there is no spring to it, then bolt firmly to the drag as shown in Fig. 3. Then roll over and lift the ring out, and take the five wings as shown in Fig. 4 and drive them into the dovetail prints as shown in Figs. 3 and 4 and place the whole core ring back again. You can now begin ramming your core. This part of the core and mold must be rammed very firm and even, as you will notice there must be a very great pressure on a casting so deep. In the center of this core you can ram a good-sized plug and when partly rammed pull it out and put cinders in, laying a bed of cinders all over that part of the core; then put the top half of your pattern on, leaving the center open, and all of the rings off the pipes, through this center opening, which is about 18"; you can ram this part of the core, then you ram the pipes up, using several rings in each as shown in Fig. 6; these will hold the sand well together and enable you to get one or two good clear vents through the pipes and out of the cope. When you have the core rammed, you put two pins in the drag, or four if you so desire; pins to be made with a shoulder as shown at Fig. 5, and bolted securely in the lugs. These pins can be long enough to guide the cheek off all the way and can be removed when the box is closed to make room for a bolt and to save the pins when shaking out and avoid the danger of bending them. If this cheek is nicely barred you will not need very many gaggers, and it is easily rammed up.

You will notice the rings at the top of each pipe of the dome are fitted nicely over them and can be placed on without using any pins, so that when your cope is lifted

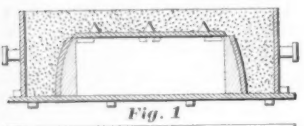


Fig. 1

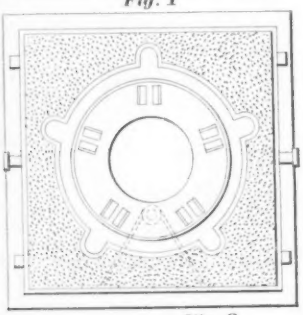


Fig. 2

Fig. 7

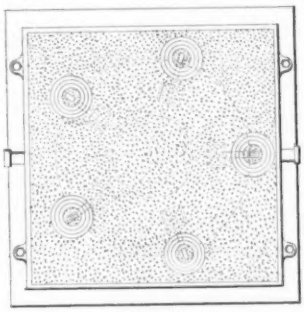


Fig. 8

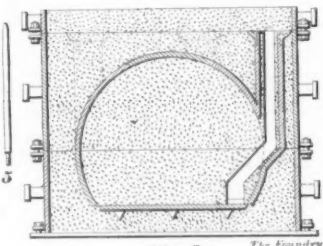


Fig. 3

The Foundry

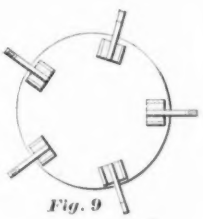


Fig. 9

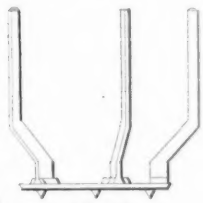


Fig. 4

Fig. 5

Fig. 6

off you draw the rings, lift the cheek, draw the top half of the pattern, then hook on your core at the three places shown in Figs. 4, 8 and 9 and lift the whole core out; draw the bottom half of the pattern, and all your mold is open and you can finish the mold very easily. Cut your gates, replace the core, which is very easily done, as each guide on the ring goes into the three sockets shown in Fig. 7 and fits exactly in its own place; close the cheek; then close the cope, remove the pins, put in all your bolts, make your runner and cast.

Now a few words about the good points of this rig. After you get the casting out all the sand will fall out of the core through the core ring as shown in Fig. 2, and the whole core iron will drop out a few inches; you can then very handily place a small bar or chisel back of each wing and drive them in, and all of your core irons comes out without any trouble, ready to be used over again. This job had never been made this way before. They had been under the necessity of rolling the flask over twice, lifting the drag first and withdrawing the lower half of the pattern, then replacing the drag and rolling the whole flask over to remove the upper half. The pipes had been secured by standing rods up in the core, and it can readily be understood that if there were any accident you would run a good chance of losing the entire mold. If any of the pipe cores got broken it was not so easy to mend them as when the core is removed. Another recommendation of the new system that would perhaps appeal more forcibly to an employer's reasoning: while it took a molder two days to make a casting the old way with the many chances of loss, with the better rig the same molder made one each day for 45 days and did not lose one. That same flask and core iron was in use about three years almost every day and was as good at the end of that time as at the beginning, so that it amply justified the initial cost.

I argue, therefore, that it pays to make good patterns, good rigging, and supply good tools and facilities for molders to work with, and to see, thereafter, that they are well taken care of, for the very best of things will become bad in time if they are not constantly cared for and kept in repair. —"Ironmonger" in Iron Molders Journal.

The Canteen's Effect.

Charles C. Peterson, a foreman at the foundry of the Malleable Iron Co., was the first witness this morning in the hearing before Judge Roraback in the Superior Court, of Frank Petrosi's appeal from the county commissioners' refusal to grant the appellant a liquor license at 219 Railroad avenue. Mr. Peterson testified that there were between 50 and 60 men under his employ. It was a frequent occurrence for the men to absent themselves from the factory during working hours. Witness had detected them bringing beer into the factory in pails. Had seen them coming from Petrosi's place and had often been told they obtained their beer there. The practice was a detriment to the shop. The men had become so intoxicated that it was dangerous for them to carry ladles of molten iron. Didn't discharge the men for these violations of rules because it was often difficult to replace them. Besides going out of the Railroad avenue gate it was possible for the men to go out by way of Johnson street. Having no regular working hours it was impossible for the company to guard against the men going in or out.

Judge DeForest—A temperate man is a better workman, is he not, than a drinking man?

A.—I don't know. I don't believe I ever had one in my employ.

Albert S. Wells, general superintendent of the Malleable Iron Co.'s factory, and the signer of the remonstrance which occasioned the turning down of Petrosi's license, also testified as to the detriment to the company's business occasioned by the proximity of Petrosi's saloon. Several other witnesses from the Malleable Iron works testified to the same effect.

Each of the witnesses was subjected to an extended cross-examination. The length of the hearing is exercising a very evident depression on the many witnesses who have sat through two hot days to tell what they know about the beer-drinking proclivities of some Hungarian molders. — Bridgeport (Conn.) Standard.

Recently Carroll D. Wright, commissioner of labor, has been investigating the relative conditions of making plows now and 50 years ago. He finds that 52 men are now employed in the making of a single plow,

against two half a century ago. The different operations now are 97 in number, as against eleven then. Taking 10 plows as the unit of computation, he finds that the two workmen of that day took 1,180 hours to make them, while the 52 men of to-day take but 37½ hours. While the labor cost of 10 plows was $54.46 in 1850 and is but $7 now, the wages paid have risen from 60 cents a day to a range of from $1.25 to $2.60. It furnishes another demonstration of the truth of Schoenhof's economic paradox that "high-priced labor gives a low-priced product."

Hardening Copper.

As a result of an argument concerning the fabled hardening of copper, Mr. A. W. McCaslin, master blacksmith on the Pittsburg & Lake Erie Railway, at the McKees Rocks, Pa., shops, made trial of the case hardening process upon some pieces of copper. Four pieces were placed in a box filled with granulated raw bone and baked for 15 hours. After being taken out, one piece was quenched in fish oil, one piece in salt water, one piece in a solution of saltpetre and yellow prussiate of potash in water, and the fourth piece was allowed to cool in the air. The only piece which gave evidence of being affected was the one which had been quenched in fish oil, and that was affected but slightly. The same pieces were then baked in yellow prussiate of potash for 15 hours, and then cooled in the air, but all to no effect. There was no result expected from this experiment, which was made purely as such, but it is evident that there can be no carburization of copper from this trial.

Use Tallow Instead of Oil in Making Plaster Casts from Wood Patterns.

Here is something that is well known in some shops, but for the pattern shops where they only use plaster of Paris occasionally it may prove useful. Instead of rubbing oil on the pattern, try tallow instead, and the result will be much more satisfactory. The former swells the wood and has a tendency to make the pattern stick to the plaster, often causing the corners to break off. Tallow does not soak into the wood, consequently the pattern will draw very nicely, and leave a smooth surface to the mold.—C. C. R. in American Machinist.

As Soon as they Get Through Threshing.

Hiatt Bros. are arranging to put in a foundry and machine shop at this place after they get through threshing. They are well adapted to such work and will have to employ no one to help, as they are competent to do all the work themselves. It is an enterprise much needed and the shipping facilities at this place make it a splendid location. We wish them success. Score one more for our city.—Moravia (Iowa) Moravian.

Mixture for White Metal Patterns.

Spelter	3 parts
Lead	1 part
Block tin	92 parts
Bismuth	1 part
Antimony	3 parts

This mixture can be melted in a common babbit ladle on ordinary forge. Great care must be exercised to avoid overheating. Pour immediate when fusing point is reached. Melt antimony first, then add the zinc and other constituents, tin to be placed in ladle last. Beam dust makes a very good molding sand to make these patterns. The above mixture makes a pattern far superior to any other metal.

George Gray, of the Reid & Gray, Dunedin, New Zealand, writes us that good molders in that part of the earth receive ten shillings per day of eight hours. At the present time the foundries there are busy making gold mining machinery and good men are scarce.

How Would You Do It?

Would like to ask some readers of THE FOUNDRY what method they would employ in making an iron casting 7 feet long, 13 inches wide and 3 inches thick, in which is to be cast a two-inch gaspipe, running within two inches of one end, then curving back so that both ends project from the same end of casting.

I have made several of these, coating the pipe with a wash of plumbago, to which was added nothing glutinous, but invariably the casting was honeycombed directly over the pipe.

Have also experienced a difficulty in making the pipe retain the position in which it was anchored. D. H. R.